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SOUTHERN AFRICA

The Land and its Peoples

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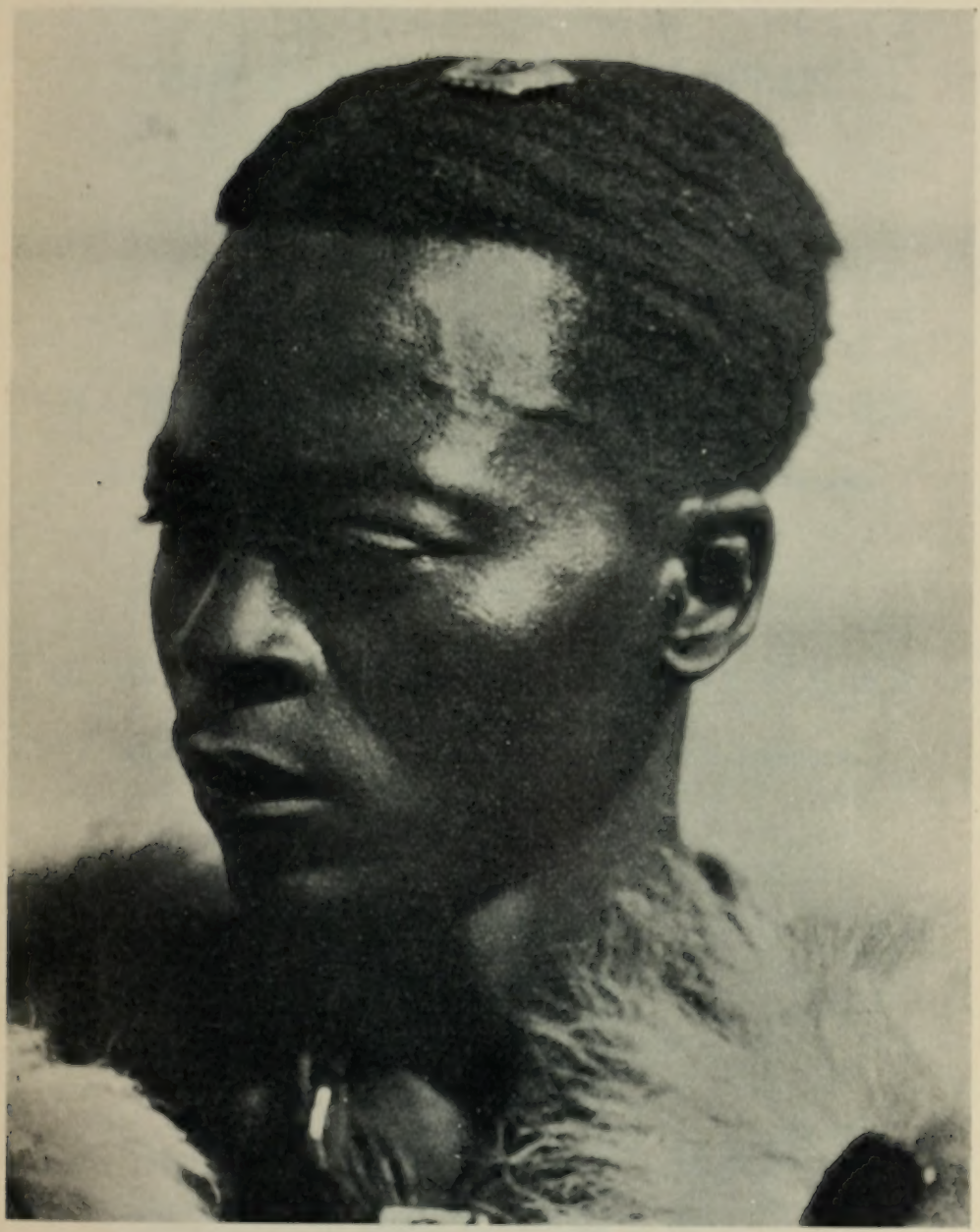

Photo.] [*C. V. Hougaard, Esq.*

MTSHANGANI (BANTU), PORTUGUESE EAST AFRICA.

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SOUTHERN AFRICA

THE LAND AND ITS PEOPLES

BY

H. HUTCHINSON, B.Sc. (Hons.), F.R.G.S.

GEOGRAPHY DIPLOMA, LONDON;
LECTURER IN GEOGRAPHY, CAPE TOWN TRAINING COLLEGE
AND UNIVERSITY OF CAPE TOWN

AND

J. W. NANKIVELL, B.A. (Hons.), F.R.G.S.

GEOGRAPHY DIPLOMA, OXFORD;
GEOGRAPHY MASTER, DIOCESAN COLLEGE, RONDEBOSCH

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PREFACE.

It is to be hoped that this brief study of the geography of Southern Africa will be of value to candidates for the Matriculation and Senior Certificate Examinations and to first-year University students, as well as to the general reader. The work was first begun by Mr. H. R. Storey, B.A., F.R.G.S. It is greatly to be regretted that on appointment to an inspectorship in the Eastern Province Mr. Storey was obliged to relinquish his share in the writing of the book.

The first sections of the book are of interest to students of historical geography and geology, and are not necessarily to be read as an introduction. In particular, the chapter on Structure and Relief should be read before the section dealing with Geology.

The book contains numerous photographs, but only a limited number of maps and diagrams. The sketch-maps commonly found in text-books are an inadequate substitute for the accurate maps to be found in the Atlas. Moreover, such maps are surely of greater value if they are the work of the student.

Statistics of production represent normal conditions rather than the abnormal conditions that have prevailed during the recent depression. Population statistics, however, are based on the most recent census.

The authors wish to make various grateful acknowledgments: to Town Clerks all over the Union, who supplied much valuable detail relating to particular districts; to C. S. Groves, Esq., of the Michaelis School of Fine Art, who drew many of the maps and diagrams; to Professor Adamson, of the University of Cape Town, Dr. A. W. Rogers, Dr. A. L. du Toit, Captain Sneyd, Mr. O. J. S. Satchell, and to A. M. Duggan-Cronin, Esq., who supplied either photographs or much valuable information; and to C. V. Hougaard, Esq., and A. van R. van Oudtshoorn, Esq., for several delightful photographic studies.

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INTRODUCTION.

1. DISCOVERY.

He who studies a map of the world showing the coasts in outline only will be amazed that South Africa was not discovered by civilized man until the fifteenth century, nor the interior of the 'Dark Continent' until within the last hundred years. The causes for this, although numerous, are not immediately obvious. Northern Africa, as part of the 'Old World' civilization, was accessible to travellers by land and sea. The traders who sailed the 'Great Sea' were bold and intrepid adventurers, especially if prizes for success were apparent, and endowed, if not with great, yet with a considerable amount of material resources. The Phoenicians were undoubtedly mercenary in spirit, but one would have imagined that the curiosity of the Greeks, the founders of modern geography, would have been an impelling force driving them to discover the furthest bounds of Africa. As a rule, however, "ancient explorers, with hardly an exception, were intent on some form of worldly success," and it seems likely that they realized how little Africa had to give them in return for the hardships they would suffer before penetrating the interior.

The disadvantages militating against the discovery of both the coasts and the interior of Africa were very numerous; even to-day modern science is often baffled by the great problems of African climate and physiography. We can summarize these drawbacks in fourteen short paragraphs.

(a) Penetration from the north had to be on foot or by means of pack-animals. The Sahara was a sufficient drawback to penetration except for the hardiest. Traders could hope for no 'dividends' by initiating exploration overland.

(b) The ships in use in ancient days were usually smaller than 200 tons burthen, had but one mast, and were square-rigged with a square fore-sail; they were steered by a paddle and often driven by oars. They were difficult to steer and were at the mercy of contrary winds, whilst they could rarely sail for more than sixty miles each fair day. It was usual to beach the boats each night.

(c) The necessary instruments were very poor and sailors found great difficulty in determining latitude and longitude. A still greater disadvantage was the absence of the compass.

(d) The ancients could not carry in their small ships sufficient quantities of food, even though they lived chiefly on cereals, and possibly olive oil. The absence of fresh vegetables caused scurvy. More serious, however, was the difficulty of procuring fresh water.

(e) The ancients were not greatly, if at all, superior physically to the wild tribes they encountered on landing on a strange shore, and hence were easily driven off.

(f) The African natives encountered by explorers until modern times had little to sell to civilized peoples. Slaves and ivory were the principal commodities, and these were moderately easy to procure without going far afield.

(g) West Africa is a desert, and the winds away from the coast are off-shore. Ancient sailors very rarely sailed out of sight of land, except in well-known seas.

(h) The Eastern Horn of Africa is also a desert, and for half the year the winds are off-shore.

(i) Fantastic notions about the heat of land and sea near the equator were deterrents. For long it was thought that the Indian Ocean was an inland sea.

(j) The Egyptians were not seamen of the first order, and the cataracts prevented river exploration.

(k) By the time the Phoenicians had opened up the Mediterranean sea-board, they had declined as a vigorous expanding nation of traders.

(l) Although the Romans most efficiently controlled the Mediterranean, they did so chiefly to protect and safeguard their empire; they were never by inclination a maritime people.

(m) Malaria and other tropical diseases were serious bugbears.

(n) The occasional fierce tropical cyclones of West Africa terrified all early sailors.

These are by no means all the contributory causes which prevented the early discovery of Africa, but they serve to indicate why Africa, apparently part of the Old, is in essence part of the New World.

The Carthaginians, finest of ancient sailors, had no doubt an intimate knowledge of the Atlantic lying immediately to the west and north of the Straits of Gibraltar, whilst about 300 B.C. the Greek Pytheas, one of the world's greatest explorers, almost certainly circumnavigated Great Britain. Some 300 years before this great feat an even greater event is supposed to have taken place. Pharoah Necho, according to the Greek historian Herodotus, is supposed to have sent a Phoenician expedition round Africa from the Red Sea to the Mediterranean. Much doubt exists as to the truth of this story, and we can no more than mention it here. We do know that the Red Sea and the Arabian coastline were well known before this date, and it seems probable that the Arabs knew something of East Africa, even as far south as Madagascar at the same time.

The West African coast as far south as Cape Bojador was known to the Phoenicians in early times, but the rocky coast of Morocco, the trade winds there and further north, the 700 to 800 miles of

desert coastlands and the absence of minerals did not encourage the settlement of colonies. The most important voyage was that of Hanno, who has left us a lively account of his adventures. He is supposed to have taken with him 30,000 people. Near the Anti-Atlas Mountains they saw a "freakish race of men, the Troglodytes, who are said . . . . to run faster than horses" (cf. Bushmen). South of the Gambia, Hanno notes the great grass fires, still characteristic of the region. Near Sierra Leone they saw an island peopled by what Hanno called gorillas (they were probably chimpanzees, though they might have been pygmies). They were pelted with stones by the males, but they captured three 'women' who behaved most unbecomingly and fought savagely; Hanno's men killed and flayed them and took the skins home. Hanno returned to the Mediterranean owing to lack of provisions. This voyage of discovery had no results, and, like the reputed expedition of 600 B.C., was forgotten until modern times. The only other attempt to circumnavigate Africa was that of Eudoxus (c. 110 B.C.) who sailed westwards from the Mediterranean but probably did not get very far. He never returned from this voyage. From this time until the fifteenth century little more was known about Africa. Madeira was definitely explored in 80 B.C. and the Canary Islands in 25 B.C., whilst the Greeks and Arabs discovered much about Egypt, North Africa and the East Coast, even as far inland as Abyssinia and possibly Kenya and Tanganyika. Speaking generally, Africa was then, as it was to be for hundreds of years, the 'Dark Continent,' from which 'something new' could always be expected to appear.

About the end of the fifteenth century there came that great transition from the medieval to the modern age. Within a generation America and the sea-route to India had been discovered, and men began to think in terms of the modern world. "The one central and unprecedented fact of the time which can never be repeated or even paralleled in any future age" was the changed geographical outlook which resulted from the amazing new discoveries. At first it seemed as if Africa was to become open to the eyes of a world already bewildered by the discoveries in the Atlantic and Pacific oceans. But this change did not come about, and Africa, even along the coasts, was still to be wreathed in mystical and mythical tales.

It is not our purpose to recount the details of geographical discovery throughout the whole of Africa, nor indeed more than mention the salient points in the exploration of South Africa. Something, however, must be said of the events leading up to the original Dutch settlement at the Cape.

After nearly seventy years of toil, the Portuguese in 1487 succeeded in rounding the Cape. The greatest name in the list

of Portuguese navigators, however, is not that of Dias, or Da Gama, but Prince Henry the Navigator. It is true that in the middle of the fifteenth century the Portuguese were ripe for maritime adventure ; and it is equally true that no other nation possessed the material and spiritual resources necessary to send forth little ships across perilous seas. But it seems likely that the Portuguese would never have succeeded in such astonishing exploits had it not been that the age produced the right man. Henry the Navigator, in truth, is the real discoverer of the Cape. He had the vision, the imagination, and the power to prepare Portugal to take the great position she was afterwards to gain.

The Navigator was inspired primarily by a religious frenzy to discover Prester John and to bring Christianity to the peoples of India. To attain this end, he adopted the methods of the scientist : collecting and testing facts, so as to be able to reach the heathen and the fabled Christians. In particular " he had a wish to know the land that lay beyond the Isles of Canary, and that Cape called Bojador." He also wished to extend Portugal's trade, fight the Moslems and find out their true strength in the ' Dark Continent.'

The geographical and other disadvantages which had long prevented the exploration of Africa have already been enumerated. Some of these drawbacks were partially overcome during the fifteenth century. Geographical information of a general nature had been collected by the Portuguese ; the compass had been improved ; the characteristic Portuguese vessel, the caravel, had become much more manageable. The caravels used by Da Gama seldom exceeded 200 tons burthen. They had three or more masts, lateen-rigged as a rule, though two of Da Gama's fleet were square-rigged. These ships could sail close to the wind and could be managed fairly easily.

It took twelve years of strenuous effort to overcome the real and supposed difficulties in rounding Cape Bojador (1434), but for thirty years after that event there was steady progress, almost entirely under Portuguese direction. The crews of the little ships rarely numbered thirty, and the problems of food and water were almost insurmountable. The natives were hostile, as the Portuguese often seized them for slaves, and believed the Europeans to be cannibals ; so when they captured the white men " God gave them a bad end . . . . and the niggers ate the crew of thirty-five." This quotation, however, refers to some Flemish sailors : perhaps the Portuguese fared better. At any rate, Cape Verde was discovered in 1445 ; the Gulf of Guinea was reached just after the Navigator's death. Thenceforth gold-dust and native slaves were the chief objects of trade, and large fleets sailed under contract to bring home such riches. In 1475 Ruy de Sequeira reached lat. 2°S. before turning home.

The next great name in African discovery is that of Diego Cam, who, braving the Benguella Current and the ofttimes violent southeasters, discovered nearly 1,500 miles of coastline. He died in 1485, somewhere near Cape Cross. In 1487 Bartholomew Dias carefully surveyed the coast from the Congo to Walvis Bay. Here he met with one of the strong but rare northerly winds which carried him southwards for thirteen days far away from land, so that "a deadly fear took hold of the crews." When the storm abated Dias hoisted sail and went eastwards, but, meeting no land, steered northwards and anchored in what is now Mossel Bay. Despite the difficulties of navigating this coast, he ventured further eastwards and eventually reached the Great Fish River. In the course of the return journey the Cape Peninsula was seen for the first time by Europeans in May, 1488. Dias almost certainly named the Cape by the title we know it by to-day. The pretty story about the Cape of Storms being renamed the Cape of Good Hope is probably a fabrication imagined fifty years after the event by an inaccurate if picturesque historian.

The rounding of the Cape by Dias and the re-discovery of America by Columbus were the two greatest events in the Age of Discovery. The way to India was apparently now clear, and this revolutionary voyage of Dias, even more than the westward voyage of Columbus, forms perhaps the great landmark which divides ancient and medieval from modern history. Apart from discovering the eastward route to India, Dias had also made known 1,260 miles of coast.

In 1486 the Portuguese had reached the East by sailing from Egypt, and information had been gained that once the 'Island of the Moon' (Madagascar) was reached it was easy to get to India. About 800 miles of coast had still to be explored between the Great Fish River and the sphere of Arab influence on the East Coast, and the Portuguese were eager to discover this new land. It was not, however, until 1497 that Vasco da Gama left the Tagus on his epoch-making journey; he had four ships and a crew of 170 men, including a priest, together with a number of convicts who were expected to carry out the riskier parts of the enterprise.

Vasco da Gama did not hug the coastline; after leaving the Cape Verde Islands he boldly struck out into the Atlantic towards Brazil, which up to that time had not been discovered. After voyaging south-west and south he turned east, and ninety-six days after leaving the Cape Verde Islands he saw land; six days later he anchored in St. Helena Bay. Here natives (either Bushmen or Hottentots) were encountered; at first they were kindly but later they became obstreperous. The discoverers doubled the Cape on November 22nd and three days later landed at Mossel Bay, where they were entertained by the natives with

dancing and music (" a pretty harmony for negroes who are not expected to be musicians "). The natives were Bantu who, like all African natives, are addicted to dancing and ' pretty harmonies.' As the Portuguese were about to leave, the natives became hostile and demolished the pillar and cross erected by the Europeans. On Christmas Day, despite the difficulties which the contrary Agulhas current gave them, they reached Natal, and on January 11th Da Gama landed again at a small river where the natives were rich, generous and happy, and had an abundance of copper. He called this place the ' Land of Good Folk ' and the river the Copper. On January 25th Quilimane was reached, where the low-lying marshes caused sickness among the sailors. Eventually the voyagers reached the Arab sphere of influence, where pilots were found who knew the ' Indian Road ' well. On May 23rd Da Gama reached Calicut, to be greeted with a marked absence of hospitality, with the words, " May the devil take thee ! What brought thee hither ? " Spices and Christians, trade and religion were to go hand in hand for long centuries, more particularly in the land the coast of which Da Gama had just discovered.

The further details of this voyage need not be discussed here. The Cape Peninsula and the way to the east had been discovered, but South Africa was not to become settled or explored by Europeans for some years. St. Helena and Mozambique were the chief ports of call used by the Portuguese, and it was not until the rise of the Dutch and English that the Peninsula became a home for the European. Vasco da Gama, one of the greatest of explorers, never landed at the Cape, nor did the Portuguese (whose king was now " Lord of the Conquest, Navigation and Commerce of Ethiopia, Arabia, Persia and India ") set up a fort on what was the ' nodal point ' of their route to the east. They were, however, the first Europeans to publish a description of the Cape (the Lusiads, 1571.) They looked upon Southern Africa as a great nuisance, an inconvenient bulge which increased the length of the dangerous voyage to the fabled East. For several centuries South Africa continued to offer no attractions to Europeans. The natives had little notion of trading ; harbours were few and dangerous ; except at the Zambezi delta there were no inviting rivers or open fertile plains. Table Bay alone was occasionally used for procuring fresh water and possibly meat.

2. THE EXPLORATION OF SOUTH AFRICA.

During the sixteenth century, as we have already noted, the Portuguese never took effective control over the ' Gateway ' to the Indian Ocean. On the East Coast they settled in many places (*see* p. 32), but the present Union of South Africa never

came under Portuguese influence. Towards the end of the sixteenth century Spain controlled Portugal, and with this event came the settlement of the Dutch at Table Bay.

The Dutch, no longer permitted to trade with Portugal, were compelled to reach the Indies themselves, for they were the great middlemen who distributed the wealth of India to Western Europe. In 1602 the East India Company received its charter, and the Indian Ocean carried the ships of the Dutch to their newly-won East Indian Empire. The Cape was the place at which all ships called, and for thirty years Dutch and English ships put into Table Bay for fresh water. They also picked up letters which had been left under stones near the sea. In 1620 two Englishmen took possession of 'the Bay of Saldania,' as Table Bay was then called, but James I. refused to accept this gift. It was not until 1652 that Jan van Riebeeck, who had previously spent a year at the Cape after his ship had been wrecked, was sent out to build a fort, plant a garden, and be ready to supply sailors with water, meat and vegetables. Next to the discoveries of Dias and Da Gama, this decision of the Dutch to make 'a refreshment house' at the Cape is the most important date in the historical geography of South Africa.

We may at this point briefly describe the events in the exploration of the sub-continent, but of necessity these paragraphs can be little more than a mere catalogue. The reader is advised to refer to the narratives and biographies of the great explorers, who usually describe the discovery of new lands with great vividness.

Except in the Peninsula, real exploration did not begin until 1660. In that year the Oliphants River was reached, and eight years later Mossel Bay was re-discovered by an overland route.

In 1685 Simon van der Stel made his famous journey to Little Namaqualand, where copper was discovered. The Dutch sailed round the coast, reaching Natal in 1705 and Delagoa Bay in 1720. In 1752 Beutler, travelling overland, opened up the Cape as far as East London. In 1760 the Orange was crossed, and in the following years much of Namaqualand was explored. The confluence of the Vaal and the Orange was discovered by Gordon in 1767. The vast tracts of new country bordering the Orange were explored by Gordon and Paterson in 1779; in the previous year the latter explorer had crossed the Great Fish River. Other regions of the Cape and of 'Kaffirland' were visited by the naturalists Sparrman and Le Vaillant. Walvis Bay had been reached before 1800. A map of all the territories discovered up to this time was made by the eminent geographer Barrow.

In 1801 Truter and Somerville nearly reached Lake Ngami, whilst two years later Lichtenstein explored much of the country to the west and north of the Vaal and the Orange. About this

time large areas beyond the Vaal were traversed by the zoologist Burchell. In 1812 Campbell, who had previously mapped the Orange, discovered the source of the Limpopo. Much of the coast, particularly the Delagoa Bay region, was surveyed by Owen between 1822 and 1826.

More systematic exploration began with the Great Trek of 1833 and with the formation of the Cape of Good Hope Association for exploring Central Africa. In 1834 Smith reached the Tropic of Capricorn and explored the Limpopo Valley. Harris penetrated Bechuanaland in 1836, and by 1844 Cowie, Green and Wahlberg had explored much of Natal and Eastern South Africa. Meanwhile Moffat and other missionaries gave more detailed accounts of these new lands. Between 1841 and 1849 Livingstone travelled widely in the Kalahari and Ngamiland, and in the following year explored the Upper Zambezi. About the same time Galton and Anderson attempted to reach the Zambezi from Walvis Bay. Travelling together they only reached the Etosha Pan, although in 1853 Anderson pushed on to the Zambezi and later explored the Okavango. Chapman also travelled extensively in this country.

Garriot journeyed from Durban to the Upper Limpopo, mainly by water, and in 1868 the Oliphants River was explored by Erskine. Much of Bechuanaland and the Orange Free State was visited by the zoologist Fritsch. By 1872 gold was known to exist in Rhodesia ; in 1868 Zimbabwe was seen by Renders. Further exploration between 1864-1880 was carried on in Bechuanaland by Anderson, and in the Transvaal and Southern Rhodesia by Hobart. The celebrated hunter Selous knew the country between Lake Ngami and the Zambezi intimately. Matabeleland and Mashonaland were accurately described by Kerr in 1884. Since this time much of South Africa has been surveyed in detail, and although accurate topographical surveys cover only a certain proportion of the country there are few extensive areas which have not been studied, at least in outline.

3. SOME GEOGRAPHICAL FACTORS AFFECTING SETTLEMENT.

For many years the Europeans at the Cape were very few in number, and it was not until 1657 that nine men were discharged from the company and settled as farmers at Rondebosch. Holland did not desire to colonize South Africa, and for some time she forbade those at the Cape to settle away from the Peninsula. The Cape was merely an appendage to the Dutch East Indies and not, ostensibly, the nucleus of a new colony. In Holland there was no surplus population clamouring for new lands, and,

even if there had been, the wilds of Africa were not sufficiently attractive to draw people away from the Homeland. The land did not appear to be suited to farming, and the Dutch, unused to a Mediterranean climate and not at home in regions so devoid of waterways as the Peninsula, saw few attractions in the settlement.

To produce food sufficient to supply the 5,000 odd souls who visited the Cape annually and to feed the more permanent inhabitants cheap labour was necessary, and for this reason slaves were imported from West Africa, Delagoa Bay, Madagascar and the Indies. The importation of slaves was an event of dire importance to South Africa. Socially, politically and economically the consequences have been extremely serious. The policy was the less excusable in that the temperate climate of South Africa permits the white man to do hard physical work without deleterious results.

The first settlement away from the Peninsula was made near the Hottentots Hollands in 1672, and in 1679 Stellenbosch was founded. The demand for grain and meat at the Cape was increasing, whilst Dutch and German immigrants and servants discharged from the Company were increasing the male population. Later some 200 Huguenots were brought to the Cape, and these, together with the surplus men at the Cape, were settled on farms in the Berg River Valley.

For many years these little colonies at Stellenbosch, Drakenstein, Paarl, French Hoek and Tulbagh were quiet agricultural centres, occupying some of the best land in the winter rainfall area. The settlers beautified the lovely countryside by planting trees and building those expressive houses and barns which mark the evolution of a distinct type of architecture.

The new colonies were separated from the Cape Peninsula by the sandy Cape Flats, which were always most difficult to cross. In many ways they were as much separated by these drifting sands, inhabited by savages and wild beasts, as if there were a strait of water between the old and the new colonies; in fact water would have been preferable to sand. Because of their relative isolation the colonists who had settled inland developed differently from those who lived near the sea. The sands and the 'Mountains of Africa' were crossed only when economically essential.

The settlers at Stellenbosch and Paarl were interested not only in agriculture but also in cattle, which were in great demand at the Cape. Hence younger sons were persuaded to lead a wilder, freer life as cattle farmers in uninhabited valleys like the Tulbagh basin and the Breede Valley or on the Karroo. Others crossed the Hottentots Holland mountains and moved towards Cape Agulhas. So was born the Boer—a man who paid a nominal rent for 6,000 acres, a nomad living in a movable house and used

to change of pasture with change of season, a maker of new frontiers and imbued with a hatred of taxation and of town officials.

These settlers learnt to do without luxuries, which, owing to the absence of roads, would have been difficult to procure. Later on they looked with some abhorrence upon the easy luxurious life of the townsmen. Thus had geography altered the descendants of fishermen, sailors, traders and industrialists—a folk gregarious and town-loving. To-day easier movement is again changing the outlook of the descendants of the original settlers.

By 1750 the Swellendam district had been opened up and farms were formed east of Mossel Bay and northwards to the Oliphants. Soon the Great Karroo and later the Calvinia district were occupied. Here the Boer learned two things, that big farms are essential and that water is precious. Both of these factors are of great importance in the later history of the Dutch farmers.

The trekkers probably reached the plateau by Blaauwkrantz Pass. Here the Great Escarpment is lower and much broken. Sutherland, Fraserburg and Zak River were reached about 1760. On the Karroo travelling is easy but water is scarce; hence developed that love of the wide open veld and the constant importance of the 'fontein.' The increasing distance from civilization, represented by the tax-gatherer, the official, the trader and the sailor helped to make the farmer hospitable and religious, but conservative and suspicious of new-fangled notions.

The mountain passes of the south-west were difficult to cross, but not so difficult as those of the south. In fact even to-day the longest transverse valley in the Folded Region has no railway through it. The first crossing-place was Robinson Pass. Settlement proceeded slowly, but by 1786 Graaff-Reinet had become the seat of a landdrost (magistrate). From this time until about 1830 three factors prevented rapid expansion: the massive escarpment in the north, the tangled eastern highlands beyond the newly-formed Somerset East settlement, and the presence of the Bantu. It was agreed that the Lower Fish River should be the boundary between black and white territory, but both Bantu and European constantly crossed the line. Geographically a river unites rather than divides a region, and in any case a South African river is easily crossed throughout most of the year. After 1780 cattle raids began to be serious, and these led to constant bickerings and petty wars. Frequently the farmers were fighting commando-fashion for months at a time; this influenced their lives not a little.

The commando method of conducting warfare is the direct result of the geography of the country. As in Spain, guerilla warfare developed naturally. Wide open spaces meant 'forming laager' when necessary. The difficulty in obtaining food supplies for large armies, the sparseness of the population, the distance

Zulu Woman.

Photo.] [*S.A.R. Publicity Department.*

WILDEBEESTE, KRUGER NATIONAL PARK.

Photo.] [*Dr. R. S. Adamson.*

KARROO, CALVINIA.

from the large towns, the lack of good communications and the very openness of the veld are some of the reasons which made for the commando and the independence of the individual, both typical of warfare in South Africa. In the wars on the northern border of the Cape Colony against Bushman and Hottentot, and more strikingly in the Boer wars, guerilla tactics were both the strength and the weakness of the Boers.

The commando system of warfare was also effective in the lofty and tangled highlands and narrow gorges of Basutoland and the adjacent areas, but in the Eastern Cape the more broken landscape led to artificial fortification, and much of the eastern border is still dotted with small forts.

Before the British occupation (1795) two of the magistracies, Graaff-Reinet and Swellendam, became republics. The causes of this were partly political but largely economic and geographical. The political views held in Cape Town regarding the way the Bantu had to be treated never pleased the farmers on the eastern border. The variability in demand for cattle and the prices paid for them were disturbing factors, whilst drought regularly upset the settlers' lives. Above all, the distance from the capital and the fundamental difference in outlook created a demand for independence. Economically, moreover, the Cape Midlands were more closely bound to the towns of the south coast.

The Great Trek. Geographically the causes of the Great Trek were the farming habits of the colonists away from the towns. They desired land, but could not trek eastwards without encountering the Bantu. The Boers felt no security and were given none; so they packed up, nomad-like, and moved even further away from 'civilization.' Once the escarpment had been crossed the wide plateau lay open before them, and their land-hunger, their wish to exploit black labour, and their desire to cherish the semi-religious doctrine that Black and White could never be equal in the sight of man and God, could be satisfied.

One party found movement fairly easy in the present Orange Free State and beyond to the Zoutpansberge; here the vegetation was far better than in the Colony, but the ports were becoming increasingly remote. So began the search for Delagoa Bay, or for a harbour they could freely use. After difficulties with the Bantu and with tsetse the trekkers formed a number of republics which eventually united to form the South African Republic.

The Republic of Natal was approached not by the easily penetrated lowlands, but by many difficult northern passes in the escarpment. The trekkers endeavoured to establish communication with settlements in the area granted by Chaka to Europeans. But settlement was difficult among the hostile Zulus, and for months the trekkers rarely moved from 'laager.' In fact the

necessity for adequate protection was so urgent that Pietermaritzburg was founded as a camp, in a region where food supplies were plentiful.

Natal has always been cut off from the Cape Province by hilly and wooded country. The Escarpment and the impregnable mountains of Basutoland divide it from the plateau, although there are passes by which these barriers may be crossed. After British authority had become effective the Boers moved away, soon abandoning Utrecht and the little Klip River Republic. In 1845 the Colony was bounded by the Tugela River from Newcastle to the sea, and southwards by the Umzimkulu River. The constant native menace led to subsequent annexation, although Basutoland remained politically independent under Moshesh. After the Zulu wars, Zululand (1887) and Tongaland (1897) were joined to Natal, although the Transvaal endeavoured to secure much of this land, together with St. Lucia Bay. In 1902 Utrecht, Vryheid and part of Wakkerstroom, all geographically connected with Natal although associated historically with the Transvaal trekkers, were added to Natal.

The presence of the Bantu and the discovery of minerals caused constant difficulties in the settlement of boundaries. Westwards the absence of striking topographical features made a convenient boundary a difficulty; to-day many of these boundaries are mathematical rather than natural. Eventually the boundary between the Orange Free State and the Transvaal was settled as the Vaal. In the south-east and on the west the presence of the Basuto and the Griquas complicated matters, and the final adjustment of these boundaries owed little to geography.

The English experienced the same difficulties in ruling the Orange River Colony (1845-1854) as they had in controlling the Eastern Province. The population was small and widely scattered, English and Dutch wished to control the natives in different ways, communications were poor, an army and a large body of officials had to be maintained, whilst the financial resources of the colony were small. The Transvaal experienced the same difficulties on an even greater scale.

The Boer War. Geography of course played a predominating part in the fortunes of the Boer War. The topographical features naturally varied in every area, and these were as important then as in every war. But there were wider geographical factors which were of great importance. Many of these have been indicated previously, but they were more noticeable now because the Boer Wars were on a larger scale.

The Transvaal and the Orange Free State were in a fortunate, because central, position, but they suffered from the lack of a seaport. They presented a very extensive western and south-western front, whilst in the east the massive escarpment caused

attacks to be concentrated on a few passes. Mobile forces centrally directed could easily move outwards from the compact centre, whilst the attacking forces were deployed on a wide front. The food supplies of the well-watered Republics were fairly plentiful, and the widely scattered farms could generally feed a commando flitting hither and thither. Movement was not difficult within the Republics, and cavalry were rarely impeded by inclement weather or rough country. Guerilla warfare was of course the most sensible mode of fighting. The Dutch excelled in this, whilst, until later in the war, the English had few cavalry.

The self-sufficiency of the Dutch favoured them to a certain extent, but they suffered severely from lack of munitions. Financially also they were not in a strong position. The British had the great advantage of large supplies and the control of the ports; they also controlled the railways as far as the boundaries of the Republics. They were, however, ignorant of the country and were badly equipped with maps. Their methods of conducting operations during the greater part of the war showed great ignorance of geographical features. They brought infantry and artillery against mounted infantrymen. Eventually they were compelled to adopt the sensible methods of their opponents.

The shortest way to the platteland was through Natal. This is nearest to the steepest part of the scarp, but certain 'poorts' allow fairly easy entrance. These gorges, however, are guarded with facility by a small force. As a rule the British tried to gain the plateau by rushing these passes, and naturally they failed. The chief line of entrance from Natal was that along the Durban-Johannesburg railway, which is guarded by Ladysmith. This district was therefore of great importance in the war. In the south the railways from East London and Port Elizabeth led directly to the Orange Free State over the escarpment, which is here much more open, though none the less suited to guerilla fighting. Colesberg controls the route, and was the scene of many an engagement.

On the west there was little to prevent easy entrance from the Cape Colony or Bechuanaland to the Republics. The railway, however, was attacked again and again by guerilla bands, especially towards the end of the war, and the British had to guard the line with wire and patrols.

There are of course many other points of great interest connected with the Boer wars which cannot be dealt with in this book. The student is advised to follow the course of the wars on a large scale physical map and with the assistance of the Historical Atlas.

Federation. Geographical factors prevented federation rather than aided it. Until communications by rail and road became more or less ubiquitous it was impossible to expect federation

between the different provinces. Grey and Carnarvon both tried to bring about federation in order that the whites might strengthen each other. "Government is largely a matter of communications." Federation could only be successful when the different entities had discovered common interests and when inter-provincial trade had begun to develop. Apart from roads, railways and motor transport, improved postal and telephone services and the wireless are all bringing the platteland into closer touch with the coast.

The Settlements. It is impossible to deal with even the chief towns in the Union here, but it seems desirable to indicate in what way typical sites were chosen. The bigger towns are the seaports and those on the gold and diamond fields. (It is noticeable that in South Africa coalfield towns are small.) Bloemfontein is the only large central city. Around the coast little bays of fairly deep water have been used as fishing harbours, although they have rarely developed into large towns, as frequently the immediate hinterland is poor and the larger seaports (Cape Town, Mossel Bay, Port Elizabeth, East London and Durban) have fair harbour facilities and are linked to the richer north.

Before the discovery of minerals the scattered population disliked urban life. The majority, who were pastoralists, lived on widely-spaced farms of vast area, much as they do to-day away from the towns. Except to visit relations, even the Cape Colonists seldom visited the larger towns. Their farms were situated near *fonteins*. On the higher land the density of population was slight even compared with to-day's average low density. On the lower coastal lands, especially in the winter rainfall area, cultivation was usual and the density was comparatively heavy.

In the coastal lands most of the towns were situated in the river valleys, where there was water for irrigation and where the better soil was situated. The determining factor was the church, the meeting place for the quarterly or monthly *nagmal* (communion). As everybody met here regularly, the church was built where there was sufficient grazing for the oxen and water for man and beast. Frequently to-day the best farms are near the church. Often a spacious grassy square shaded with trees was preserved as an open space with the church in the centre.

Near the church the land was divided into 'erven' or plots. A little hotel would be built to accommodate the congregation, for the nagmal was the only occasion when farmers could meet and there would be much to discuss. In time the church would become the nucleus of a little community comprising a school teacher, a shopkeeper, a blacksmith and waggon-builder, and members of the professions.

Photo.] [*S.A.R. Publicity Department.*

GROOT CONSTANTIA, C.P.

Photo.] [*S.A.R. Publicity Department.*

ZIMBABWE.

On the drier Karroo and on the plateau nine-tenths of the towns originated in this way. As a rule these towns remained small even when they were the only towns in the district; and although some of them grew in size and importance with the coming of the railway or with the exploitation of minerals, it rarely happened that the population grew too big for the church. The size and architectural importance of the church even in little 'dorps' is the result of the nagmal custom. On the richer lands a new site was chosen for another church when the original church became too small, or too inaccessible for a community whose wealth in 'pioneer' days did not permit the building of a nearer church, or because of rivers being impassable during wet seasons.

In Natal most of the sites were chosen for defence, the relative importance of good land and water being not so great. The whites felt as though they were garrisons amongst black hordes. The farms were smaller and settlement was closer.

Occasionally in Natal a magistrate or native administrator set up a court, a police station, and the necessary houses amidst a purely native population. The site was naturally central and accessible, and the surrounding country was productive. Later the white settlers came as near to the place of law and order as possible, and so the town grew, attracting the professional and trading classes. Some towns came into being because they are at 'nodal points,' or because they 'guard' a pass. There are many such centres in Natal.

To-day the largest towns are, of course, on the goldfields and on the coast. The big towns tend to become bigger, especially those near the coast, whilst many of the smaller tend to become smaller. As our manufacturing industries become more important this tendency is likely to be more marked.

Southern Rhodesia. The historical geography of Southern Rhodesia, although of great interest, cannot be dealt with in a work such as this, except in the barest outline.

Rhodesian history differs from that of the Union in that written records go back to the tenth century, whilst a high civilization at an even earlier date is suggested by the presence of marvellous ruins and ancient mine-workings.

Whatever degree of civilization may have been reached in prehistoric times, no evidence of this culture was to be observed in the inhabitants first encountered by the white man. The Portuguese and, at a later date, Livingstone found the land in the possession of Bantu peoples who had probably displaced the earlier inhabitants.

It was Livingstone who described the country for the first time geographically. Selous, the great hunter, did even more to make

known the immense possibilities of the region. But it was Rhodes who brought both Rhodesias into the British Empire.

Attention may be drawn to one or two facts which have influenced the history of Rhodesia in recent years. Both Northern and Southern Rhodesia have depended largely upon minerals for their early development, and yet the exploitation of this wealth has been hindered by the absence of a coastline, for mining operations usually involve the use of machinery of a bulky nature, which has to be imported. Hence railways have had to be built to the coast through territories outside the Rhodesias.

Rhodes was particularly enamoured of an all-British Cape to Cairo railway, but such a railway would have been of little economic or strategic value, and recent developments in the Congo, Angola and in Northern Rhodesia have finally caused this idealistic railway to be thrust into the background. The railway from Cape Town to Plumtree passes over country which is not greatly productive, so that only goods of small bulk and high value are likely to use it. The shortest route from Rhodesia to the sea lay through Portuguese territory, and at great cost a railway to Beira was constructed.

South-West Africa. This territory was part of the German Empire until the Great War. It is now administered by the Union on behalf of the League of Nations, to whom an annual report is made.

It was first visited by Dias in 1486, who landed at Angra Pequina ('Little Harbour'), but the inhospitable shore did not invite settlement. From the south the territory is said to have been first entered by a hunter named Jacobus Coetzee, who crossed the Orange River in 1760 in search of game. A year later, and again in 1791, expeditions reported the existence of copper in great quantities, and of good pasture-lands. Walvis Bay, Angra Pequina, Spencer's Bay, Windham's Bay and Port Alexander were claimed by Britain in 1796. During the 19th century hunters and traders began to open up the country, whilst the coast attracted fishermen. In 1866 the Cape Government annexed the guano islands. Mission stations were also established in various centres. Development was being hindered, however, by tribal warfare, and, although both settlers and native chiefs appealed to the Cape Government to provide protection and administration, nothing was done except to send a Commissioner to enquire into the condition of the territory.

In 1882 lands to the north of the Orange River were purchased from the Hottentots by Adolf Lüderitz, a merchant of Bremen, who established a trading station at Angra Pequina, thenceforth called Lüderitzbucht. Two years later Bismarck claimed the whole of the coast region from the Orange to Cape Frio (excepting

the Walvis Bay territory and the islands), and in 1892 Germany annexed the entire territory.

The fifteen years that followed were marked by incessant warfare between the new Government and the various native tribes, in the course of which the latter were enormously reduced in numbers. The Hereros, who were the most powerful, were finally subjugated in 1908.

In 1915 German South-West Africa surrendered to the Union Forces, and in September, 1919, the Union Government accepted the mandate of the League of Nations to administer the Protectorate under the title of 'The Territory of South-West Africa.'

Since 1920 there have been occasional tribal revolts, but these have been suppressed without difficulty.

4. NATIVE PEOPLES.

When the Europeans first settled in South Africa there were four distinct races inhabiting the country. These were the Bushmen, the Hottentots, the Berg Damaras and the various tribes which to-day are called the Bantus. It is almost certain that the Bushmen were living in the sub-continent long before the others had moved southward, though it is possible that the Berg Damaras, the only representatives of the negro race in South Africa, preceded them.

Bushmen. The Bushmen are believed to have held undisputed sway over South Africa until the thirteenth or fourteenth century, when the Hottentots began to move southwards, being pushed outwards by more powerful tribes in the vicinity of the Equator. As the Hottentots were of a higher civilization than the Bushmen they drove the latter into the mountains and the deserts, and took over the best land for themselves and their herds. When the Europeans arrived at the Cape the Bushmen were already hiding in mountain kloofs; Van Riebeeck described them as "robbers, subject to none, and depending on their arrows and assegais, treacherously robbing their neighbours of their cattle and their wives." They were "without cattle, dwelling beyond, amongst the mountains of Africa." As the Bantu moved southwards they also encountered these fierce little hunters, who fought savagely against the wild invaders of their hunting grounds. At a later date the white man pushed them further into the interior. They seemed to be untamable savages who found the settlers' cattle easy prey; they constantly raided what appeared to them to be very somnolent buck. To-day these folk are only found hidden away in the wildest parts of the interior, in the still drier Namib, and in the Native Reserve in northern South-West Africa.

The Bushman has left vivid evidence of his presence in many parts of Southern Africa. In caves and on certain rocks he has painted lively pictures, which are remarkable for their vigour and accuracy. The cave was the Bushman's home; the entrance was protected by branches of trees, or bushes covered by the skins of wild animals. Being nomads they had no permanent homes, but set up their shelters wherever hunting was good. Often they slept in the open, crouching round the camp fire, so close that their bodies were scorched.

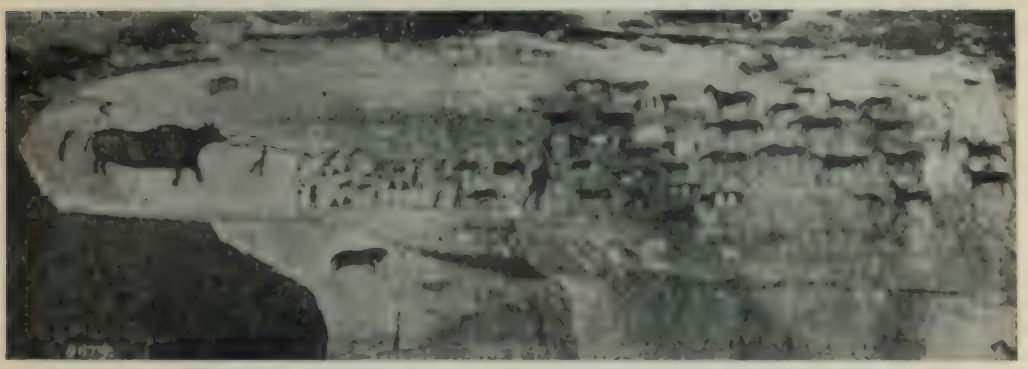


Photo.] [*S.A.R. Publicity Department.*

BUSHMAN DRAWINGS.

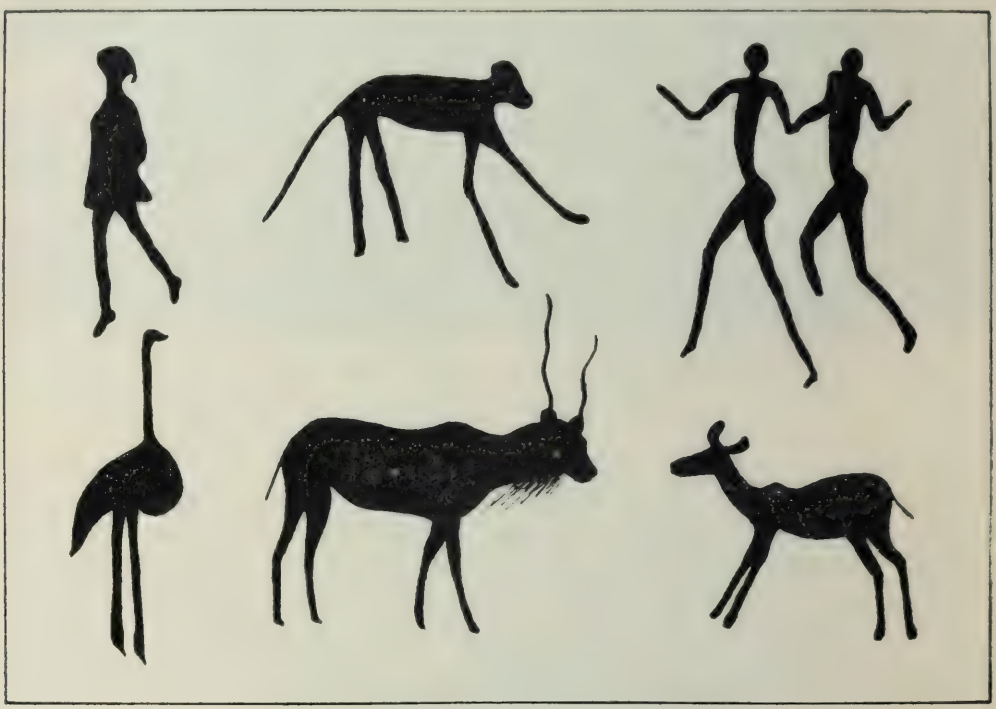
The Bushmen rarely exceed five feet in height, but are well built, the hands and feet being beautifully formed. They are usually a dark chocolate in colour, and, except for the 'peppercorn' hair on their heads, have hairless bodies. Their heads are fairly large, their eyes are slanting and their cheekbones prominent, whilst their noses are broad and flat. A peculiar feature is the looseness of the skin, especially over the abdomen.

The Bushmen are in the 'hunting and gathering' stage of civilization, and live entirely on wild game, roots, berries, seeds, locusts, the larvae of ants, honey, gum, fish, snakes, reptiles, birds and vermin. Their only domesticated animal is the dog, "generally lean and hungry-looking mongrels, half-starved and savage-tempered, but excellent assistants in the chase" (Schapera). Often they have to go without food for long periods, but they make up for the hungry periods by gorging prodigious quantities in times of plenty. They store and carry water in ostrich-shells. They do not wash, nor do they wear clothes, a loin-cloth being sufficient; though they sling skins over their shoulders and use them at night as bed-coverings.

They have wonderful qualities as hunters, having remarkably good sight and hearing, and being able to run for enormous

distances. Their weapon is the bow and arrow, the latter being tipped with a poisoned head of bone, stone, or iron. To assist them in the hunt they call upon powerful spirits, but little is known of their beliefs.

Formerly the Bushmen lived in clans, which had the right to hunt in certain areas. If one clan invaded the 'grounds' of another, the trespassers were liable to be killed. They looked upon Europeans as invaders of their sacred 'grounds,' and could see no wrong in lying in ambush and shooting a poisoned arrow at the white man, or in hunting his cattle. But gradually the



Bushman Paintings.

Bushmen gave way to the superior arms of the European, and, although occasionally used as herdsmen, they resisted any efforts made to civilize them. Where still found, the Bushman lives the characteristic life of the nomad hunter, but very few now remain.

Hottentots. The early settlers rarely distinguished between the Bushmen and the quite different racial type, the Hottentots. The latter were of a far superior civilization and had already reached the pastoral stage. It is possible that their early home was in the neighbourhood of Somaliland, but physically they have Mongolian characteristics, though their hair resembles that of the Negroes. The Hottentots, besides being pastoralists, could

Photo.] [*C. V. Hoogvaard, Esq.*

BANTU, NORTHERN TRANSVAAL.

Photo.] [*A. van R. van Oudtshoorn, Esq.*

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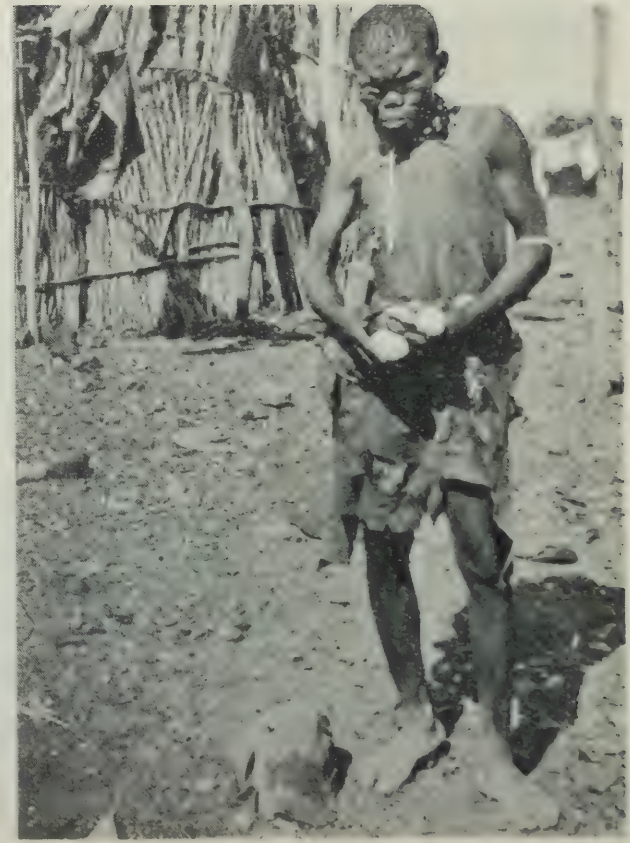


Photo.] [*S.A.R. Publicity Department.*

BUSHMAN.

work iron and copper, but nearly all authorities are agreed that they lacked the vigour of the Bushmen. They called themselves 'Khoikhoin,' *i.e.*, 'Men of men' or 'Men of one race,' but the Europeans gave them their present name because they often used the word 'Houtitou' in their dances. They are of medium stature and brownish-yellow in colour, and have beautiful and very clear black eyes, but their noses are flattened and their lips are thick. When youthful they are shapely in figure, as their necks, legs and arms are slender and well-formed, but as they get older their protuberant buttocks make them unsightly.

Their languages can be divided into four groups, although all are characterized by "clicks . . . . like those of turkey cocks: they clap or clack each word in the mouth . . . . so that their mouth goes almost like a rattle" (Dapper).

The early colonists found the Hottentots living in small groups as far north as the Orange River and beyond, and as far east as the Kei River.

The Hottentots were not agriculturists, but nomads who drove their flocks and herds from place to place according to the grazing. Milk was their chief food, but berries and roots were also gathered by the women. These were often cooked, as was meat, procured by hunting; they never slaughtered their own animals except at rare ceremonial feasts. The land belonged to the tribe and could not be sold. Each tribe was divided into clans subject to some degree to chiefs. These chiefs formed a council, the head of which was the chief of the senior clan. Since loyalty to the clan was stronger than loyalty to the tribe, there were constant squabbles amongst the tribes.

The families comprising a clan grouped their huts together. The kraal was encircled by a thorn fence, and huts were built near to it; the centre was used for herding the cattle, which were driven in nightly. These huts, like those of all nomads, were easily erected and taken down; as they were light they could be transported by oxen. The framework was of wood. This was covered with reed mats, quite well woven. Some of them were large enough to accommodate twenty people, but as a rule they were much smaller. The modern 'matjies huis' is very similar to the Hottentot hut. These huts had no outlet for the smoke from the fires which burnt in the centre. Nearly all the kitchen utensils were made of wood, but they also made pottery and used shells as cups. Notwithstanding that they possessed sheep, they never made woollen clothes. Skins were their only covering, though a kind of tent-shaped hat was frequently worn in bad weather, and sometimes dried ox-skin shoes were tied to their feet. Ornaments, such as shells, copper and ivory bracelets, were much prized.

According to Dr. Schapera, the Hottentots had no idea of an after-world. The ghost of a dead person could leave the grave to

work evil, by bringing sickness or death to those who came near to the burial grounds. They had a definite type of religion, which was centred upon a mythical person who was responsible for ghosts, whirlwinds, eclipses and other phenomena. There was also a mythical person of righteous tendencies. He fought the evil 'god' and tried to do good by bringing health, rain and abundance. There was an annual rain-making ceremony when the good spirit was worshipped. There were several other mythical heroes and devils. Like the Bushmen, the Hottentots also paid some attention to the moon and possibly worshipped her when new and full. Magicians were numerous and wielded much power. All Hottentot warriors and herdsmen tied amulets to their persons to ward off evil, or to bring good.

The Hottentots have always had the reputation of being faithless, lazy and extremely dirty. With the Europeans they would barter their cattle and sheep for strong drinks, tobacco (of which they were inordinately fond) and iron and copper goods. When they had lost many of their cattle they would stave off hunger by stealing more or entering into service with the Europeans. Indeed, they were capable of acquiring some of the veneer of civilization, and they frequently became useful herdsmen.

The early settlers frequently had to send out commandos against the Hottentot tribes who stole the Company's cattle. They were good fighters, though they rarely united to form a firm front against the Europeans. They used assegais, bows and arrows; occasionally they tipped their arrows with snake poison. Their intimate knowledge of the country enabled them to slip away easily into mountain fastnesses, where pursuit was difficult.

Nearly all the pure-blooded Hottentots have disappeared, but they form the basis of most of the Cape Coloured population of to-day. In Little Namaqualand descendants of the old Nama tribe are almost pure-blooded, though they have lost all trace of their ancient culture, and their language is now spoken only in South-West Africa by the Nama there. They are still herdsmen, but some of them practise primitive agriculture. Their most lasting memorial is probably to be found in the names of places which commemorate their former homes or exploits.

The half-caste Hottentots, the children of European fathers and Hottentot women, were very often the forerunners of the European in penetrating into the interior. During the eighteenth century they advanced before the trekkers, frequently in bands. Occasionally these bands were consolidated by missionaries, particularly in Griqualand West and in the Orange Free State.

The Griquas, who spoke Dutch and were partially civilized, settled along the Orange River and frequently trekked as far as Basutoland and the Transvaal. Under Adam Kok some settled

in East Griqualand, but owing to their indolent habits they lost their land. To-day they scarcely exist as a distinct type.

THE BANTU. The vast majority of the inhabitants of Southern Africa belong to a branch of the so-called negroid race. To-day they are commonly called Bantu, which term really denotes a group of dark people who speak languages having many affinities. The word itself means nothing more than 'person' or 'human being.' The early settlers called them 'Kaffirs,' which was the name given them by the Arabs, who looked upon them as 'unbelievers,' imagining quite wrongly that they believed in nothing and had no religion.

It is extremely difficult to speak with any assurance about the early home of the Bantu. They had no written language, and their tribal histories were usually little but garbled 'minstrel' stories of the past, sung or related at tedious length. The Bantu are first mentioned in written records by the Portuguese who came into close contact with them after 1487 in the modern Portuguese East Africa.

The Bantu have not been in South Africa very long; in fact they reached the Great Fish River at about the same time as the Europeans. Like the Hottentots, they moved southwards from the neighbourhood of the Equator, probably from the vicinity of Lake Victoria. As they moved southwards they pushed out those peoples whose civilization was of a lower standard than their own, and took over the best land. Here they practised a type of agriculture. The Bantu, however, are primarily pastoralists. Around their herds are centred their economy, their religion and their culture. It was their custom to burn a clearing in the forest, plant certain seeds, harvest them and re-plant until the fertility of the soil decreased. Then they moved onwards to a new patch. The women were the agriculturists; the men looked after the herds, hunted and fought.

In Africa the Bantu are found everywhere south of the great 'negro belt,' *i.e.*, south of the line joining the Cameroons to Lake Victoria and Mombasa. There are innumerable tribes who are somewhat alike in their mode of life, have a similar social organization and a system of religion with many common features. The diffusion of these peoples has indubitably taken a long time, and their minor differences in culture, history and language are due to the especial weaknesses of this branch of the negroid race. Probably the initial causes of their southward movement was pressure from the north by powerful Hamitic tribes. There are several reasons why the tribes are so numerous and the Bantu as a race so devoid of cohesion. The mode of life they adopted helped to some extent to make them nomad-pastoral-agriculturists. They needed much room, so that when a tribe became too large the younger and bolder spirits moved outwards. Two more

Photo.] [*S.A.R. Publicity Department.*

ZULU WOMEN.

Photo.] [*S.A.R. Publicity Department.*

NATIVE KRAAL, ZULULAND.

potent causes were slavery and polygamy. For hundreds of years Bantu tribes were practically decimated, first by Arab and later by European slave-raiders. Only the richer men could be polygamists; in fact, only the chiefs had a great number of wives. This meant that chiefs and rich men would have many children, all of whom were born into positions of authority. These children moved outwards and founded new tribes. Naturally these children, having made themselves leaders, caused intertribal wars. Right down to modern days this intertribal jealousy has continued. Of these three factors there can be no doubt, however, that intertribal warfare was the chief reason why the Bantu were relatively weak. Despite their numerical strength and their innate ability as warriors, intertribal jealousy made them almost helpless before the united European. "The whistling of the mercileſs assegais was their ever-present nightmare," more than the firearms of the white man.

The Portuguese in the fifteenth and sixteenth centuries made settlements along the coast of modern Portuguese East Africa: the chief of these were at Sofala, Moçambique, Quiloa, Sena and Tete. They had no desire to conquer and hold the hinterland, as they were essentially traders, whilst Portugal had no excess of population clamouring for new land. The Bantu had little to trade with the Europeans, but there were rumours of a great land, the Kingdom of Monomotapa, rich in gold and silver to tempt the Portuguese westwards. This fabled kingdom was the desired goal, not only of the Portuguese, but also of the Dutch at the Cape, who sent out parties to discover this land. Monomotapa means 'Lord of the Rocks' or 'Lord of the Names'; it was supposed to be between the Zambezi and Orange Rivers. The Bantu tribe living there were called the Makalanga, a tribe which hardly exists to-day, though the Mashona and possibly the Tongas are offshoots. The Portuguese made two disastrous expeditions against these people; they brought back no gold or silver and added to the hatred already felt by the Bantu for them because of their slaving proclivities. The Zimbabwe and some hundreds of other ruins and mine-workings are survivals of the Monomotapa Kingdom. This is not the place to discuss the archæological intricacies of Zimbabwe, nor to describe the wonders of the buildings. It is held by many that these date from a distant age, that Sheba was Rhodesia ("Shur that is over against Egypt"), that Sofala was Tarshish, and that Solomon got his gold from this kingdom; others believe that this land was worked by men from Arabia, India or the East Indies; whilst still others believe the workings to be less than a thousand years of age and to be the handiwork of a negroid race. Over £20,000,000 worth of gold was mined: silver, copper and other metals were also worked.

If this was the work of the Bantu some great catastrophe has made them forget how to build and to live as the dwellers of Zimbabwe, ' the Great Place,' used to live.

We need not try to follow the migrations by which the Bantu reached their present dwelling-places, for there is little geographical interest in their movements, except that they altered the indigenous flora by burning. To-day, south of the great ' negro belt ' there are three main Bantu groups. *The Eastern Bantu* dwell in Uganda, Kenya, Tanganyika, Northern Rhodesia, Nyasaland, and Portuguese East Africa, north of the Zambezi ; the *Western Bantu* occupy the territory between the Cunene and the Cameroons ; the *Southern Bantu* live to the south of the Zambezi and the Cunene. These last we can subdivide into four groups. The *Northern* live in Southern Rhodesia and Portuguese East Africa south of the Zambezi. The *Eastern* group, comprising the Zulus and Xosas, live to the south and east of the Drakensberge ; *e.g.*, the Ama Xosa, Ama Tembu, Ama Pondo of the Eastern Province, the Ama Zulu of Natal and Zululand, the Ama Swazi of Swaziland and the Bathonga of Portuguese East Africa. The Ama Ndobele of Matabeleland, the Ama Tshangana, and the Vatua of Portuguese East Africa and Southern Rhodesia are all offshoots of the Ama Zulu. The *Central* group—the Suto and Chuana—live west and north of the Drakensberge. The Chuana, who live in the Orange Free State, British Bechuanaland, Bechuanaland Protectorate and the Transvaal, include the Barolong, the Bathloping, the Bakgathla, Bangwaketsi, Bakwena, Bamangwato, and the Bahurutshe. The Suto, beside the Basuto, include the Bapedi and the Bavenda of the North-East Transvaal. The *Western* group is found in northern South-West Africa, in Southern Angola (Herero Ovambo), and in central South-West Africa (Ovambo).

The Bantu, like many other races, are hybrids and therefore show considerable variation in physical features, though they are all more or less ' negroid.' In colour they vary from the deep chocolate, which is almost jet black, of the Swazi, to the yellowish brown of the Bechuana. More commonly they are the colour of plain chocolate, though some are almost like milk chocolate. They have little body hair and can rarely grow a lengthy beard or moustache. The head hair is of the negroid spiral type, interlocking so as to leave ' spaces ' on the scalp : the prominent eyes are black and the nose is usually broad, but on the east Hamitic and Semitic influence is apparent ; here many tribes have finer, more aquiline features with lighter colouring. The forehead is usually prominent, the cheekbones high, and the lips fleshy, thick and everted. The Bantu rarely go bald. They have those characteristics common to all African peoples which enable them to live comfortably in hot countries.

The Bantu are organized into tribes which are units composed of a number of clans whose bond is a descent from a common ancestor. The tribes are called after their ancestors, but there are so many of them to-day that it is impossible to determine their relationship. Some, such as the Zulus, the Matabele and the Basuto, were recently formed (18th and early 19th centuries); others are much older. The size of the tribes varies enormously; some number but a few hundreds. The Bamangwato exceed 60,000, whilst the Basuto are a 'nation' of over half a million. The Basuto and the Bechuana live in villages, some of which, like Serowe, are very large, but most of the Bantu on the east, north and west live in kraals which are household groups. The huts of the eastern and western groups are usually beehive in shape, whilst those of the north and centre are more often conical. The languages of the four Bantu groups are not dissimilar. Some of the tribes, *e.g.*, the Xosa, Zulu and Suto, have adopted clicks, probably from the Bushmen, though possibly from the Hottentots; these clicks were incorporated into the language when the Bantu reached the central and western areas inhabited by the Bushmen and Hottentots.

The religion practised by the non-Christian Bantu is extremely hard to describe. They are peculiarly receptive to new ideas, which they adopt and change to suit their complicated beliefs. The Bantu are rarely capable of sustained thought in speculative matters. If one could generalize about so difficult a subject, it would be correct to say that their religion is the worship of ancestors. The original father, the 'Adam' of the Bantus, is possibly also the Creator, the Umkulunkulu, *i.e.*, the great father or the distant grandfather of the tribe. This Creator is only worshipped as an ancestor. Many think that the first man and woman came forth from a reed and came quite independently of the High God. There is no worship of a Supreme Being. There are a multiplicity of ideas as to who was the first chief, but an account of native beliefs would unduly lengthen this chapter.

The Bantu live essentially in the present. The distant past is as much ignored by them as the immediate future. Because they live for the moment only, they are potently affected by all around them. Especially do they reverence or fear a man of great personality. In life they praise him in grandiloquent phrases; they invest him and his works with pompous 'praise words.' When the chief dies these praises are still kept up and they continue perhaps for several generations. The spirits of the ancestors live with them, and their dwelling-places when on earth and their clothes and other possessions are saturated with this spirit. The spirit may be material or immaterial: it may exist or it

may not exist. The whole Bantu belief is compact with contradictions. The location of a man's soul is not certainly known : it may be outside his body, say in the roof of the hut, or anywhere where the ' strong man ' can project it. Possibly their conception of the soul is what we understand by the word ' personality ' : often the ' personality ' is associated with the man's shadow, which can leave the body during sleep and haunt the earth after death. Sometimes the spirit is associated with certain animals : different tribes believe that different animals, *e.g.*, crocodiles, elephants, lions or snakes, are sacred. If one is killed then the natives apologize and even offer a sacrifice to the slain animal. Great men project their spirits into terrifying animals, *e.g.*, Chaka ' passed into ' a boa constrictor. People of no consequence pass into little animals, *e.g.*, fat old women who were lazy into lizards. If the animal dies then the spirit enters another of the same genus.

The Bantu have very elementary ideas about Nature ; in fact they hardly ever think about it and never do they appreciate the glories of their environment. Natural phenomena such as wind, rain and thunder are frequently personified. The ' rain-maker ' is an important member of the community, and official ' rain doctors ' often become wealthy. Their methods are too numerous to recount here : it suffices to say that they have a keen knowledge of local meteorological conditions and are aware of the propitious time to call upon the clouds to burst. In times of long-continued drought the rain doctor has a hard time ; even his life is in peril. Thunder is often associated with Umkulunkulu, or even with an ancestral chief. Those who are killed in a storm are ' unclean ' and the kraal or hut has to be cleansed by burning. The whole Bantu world is so populated by demons, haunting spirits and fabulous monsters that it is remarkable that they are so cheery.

The Bantu have a great belief in magic, but they do not impute all illness to magical practices. Some witch-doctors are simply men and women learned in the use of certain herbs and roots which cure ordinary ailments. Sometimes sickness is imputed to the interference of ancestral spirits, or even to fabulous monsters, but more often sickness is supposed to be due to the machinations of some enemy. It is the business of the witch-doctor to discover the enemy, ostensibly through divination. Men of evil intent, sorcerers, witches and fabulous animals who attack the tribe or the individual are also ' smelt out ' by the witch-doctor. Nominally these men are the protectors of the tribes.

The power of the chief, in whom the property of the tribe is invested, is considerable. Formerly he had the supreme power of life and death : he was the leader in all activities, both in war and peace. To him tribute was paid, usually in the form of

cattle. New clans were always being formed by the children of the chief, but they acknowledged his leadership.

The Bantu live together in kraals which are usually circular. In the centre is the cattle kraal, fenced round with sticks or stones. The huts are ranged around the cattle kraal; the whole is often protected by a wooden palisade. The children are usually fat, and wear no clothing. Many Bantu have now adopted some of the trappings of Europeans, but their usual garments are gaudy coloured blankets, beadwork, ox-hide petticoats, scanty loin-cloths, karosses, and as many ornaments as they can procure. They love to smear themselves with clay, especially red and yellow ochre, and they dress their hair into fantastic shapes.

Physically the Bantu vary greatly. Many of them are finely built, but not tall (average height 5 ft. 8 in.). They are muscular and well developed, and walk erectly. The women age quickly and then receive little attention, but old men are revered. In olden days there was much fighting. Under capable leadership the Bantus are fine fighters and collectively they are courageous, though they quickly lose heart. Not many women have more than five children. The men look after the cattle and where possible hunt game. The women scratch the soil with the hoe, and plant mealies, kafir-corn, pumpkins, sweet-potatoes, gourds, beans, yams, sugar, pine-apples, tobacco and many other crops. Rice is grown where possible. At harvest time there are great feasts. Beer is made from kafir-corn, but sour milk is the usual drink. Poultry are ubiquitous: sheep, goats and cattle are the mainstay of the tribes.

The Bantu have some artistic power. They rarely draw, but their carvings in wood and stone and their clay models are lively likenesses. Their music seems monotonous to our ears. They are extremely fond of singing and dancing; their chief instrument is a stringed stick fastened to a gourd, which acts as a sounding board. They delight in games, tobacco and dagga, but find their sheerest pleasure in gossip. The Bantu is not naturally lazy, but he will only work hard if he is interested. Now that fighting is prohibited the men have too little to do in the kraals, for they think it undignified to do woman's work. With sensible education the Bantu should develop well and become a still greater asset to South Africa.

5. POOR WHITES.

A Poor White has been defined as one of European extraction who cannot support himself according to European standards, or one who is incapable of managing his own affairs, is hopelessly indigent, and unable to alter his mode of life to suit a changed or changing environment. The term denotes a shiftless type of person, often of poor physique and usually lacking in intelligence

and education. At least one-twentieth of the white population of South Africa are in this degraded condition ; their redemption and rehabilitation is one of the most vital problems with which the statesman will have to deal. The term ' Poor White ' dates back only to about 1906, although the existence of the problem was recognized some years previously in the opening of industrial schools for the education of ' landless whites.'

Whilst in Europe the hopelessly poor and the unemployed are to a large extent products of altered industrial conditions in the towns, the Poor Whites of South Africa are essentially products of the land. Owing to a variety of circumstances South Africa has failed to evolve the self-supporting peasant-class characteristic of Europe and other parts of the world. The more important of these circumstances will be considered briefly.

In pioneer times, when a South African farm was sometimes as large as an English county, there were no Poor Whites. The sons and grandsons of farmers remained on the farm as long as it was large enough to support them, and then moved north to new pastures. Thus was evolved the trek-boer, ' religious, independent and somewhat self-satisfied.'

But such easy conditions could not persist indefinitely. In Roman-Dutch law there is no system of primogeniture ; usually the property is subdivided equally among the children. Hence farms became smaller and smaller ; the report of the 1908 Poor White commission mentions an heir whose share was 1/48,141 part of the original estate !

The farmer who possessed capital, or education and intelligence above the average, adapted himself to these new conditions by combining pasturing with agriculture ; many, however, were squeezed out. Those turned adrift were sometimes physically or mentally degenerate as a result of near relatives having intermarried with the object of keeping land within the family. (Of fifty-three children attending a Karroo farm-school in 1918 thirty-seven bore the same surname.) Others were victims of unscrupulous store-keepers and speculators : it was usual for farmers to sell their produce to agents, often at a ridiculously low price ; only recently has the farmer begun to realize that co-operation is perhaps more advantageous than independence.

What happened to the farmer turned adrift ? Occasionally he settled on someone else's land, rendering various services in return for the privilege of occupying a small area himself. He was then called a *bywoner* (squatter). But as a farm labourer the Poor White was, and is, unsuccessful. He is unpopular with the farmer, who prefers to pay much lower wages to the fairly competent native. Moreover, the dispossessed landowner considers it degrading to have to do the same sort of work as the native

labourer. Hence the bywoner often wanders from farm to farm, and eventually drifts to the towns in the hope of finding employment.

Some have been successful. Until the development of railways many earned a livelihood as transport riders, especially in areas where mines were being opened up; but this avenue of employment was only transitory. Some found employment on the mines and in other industries, whilst a large number yielded to the allurement of the diamond diggings. But the towns have not been able to absorb more than a small part of the redundant rural population, and in the slums of the larger cities the descendants of landowners live in abject poverty amidst non-Europeans, without the training that would earn a white man's wage and unable to live upon the wage of the unskilled native labourer.

It is not easy to estimate to-day the exact Poor White population of the country. Many owners of excessively small farms are too proud to admit their poverty. There is also the casual labourer, often without employment, who belongs to the Poor White class. In the towns, moreover, there are indigent English-born immigrants who made the mistake of supposing that in South Africa money could be made easily without capital, training or capacity. It is certain, however, that the Poor White problem is to-day as acute as ever; in 1927 a commission found that 'more than 120,000 of the small European population of South Africa had fallen below the economic level of the more advanced natives.' According to some authorities this is an under-estimate.

Natural catastrophes such as insect pests, floods and drought tend to augment the number. On the other hand, certain remedies have been proposed and carried out. By means of protective tariffs 'infant industries' are encouraged, so that more labour may be absorbed. Legislation has been enacted securing a favourable proportion of white as compared with native labour in certain occupations. Unskilled white workers have been given employment on the railways, in forestry undertakings and road construction, and in the Post Office and other departments. It may be doubted, however, whether such remedies make for the greater welfare of South Africa as a whole; they encourage thousands of Europeans to remain unskilled and drive the native out of employment. There is the possibility that in the solution of the Poor White problem may be created a Poor Black problem.

A conviction exists in some quarters that the Poor White must be rehabilitated not in the towns but on the land. The Kakamas Labour Colony, established in 1897 by the Dutch Reformed Church and now supporting some 340 families, is a step in this direction. It is also proposed that

excessive land-holdings should be discouraged by the taxation of unimproved lands, and that by giving him security of tenure in return for a fair rent the bywoner should evolve into the tenant-farmer.

6. PLACE-NAMES.

Following Mr. Graham Botha and the Rev. Charles Pettman, the chief authorities we have in this only-partially-explored subject, we may divide South African place-names into five main classes, viz., those of Dutch, English, Portuguese, other European and native origin. Place-names derived from native languages may be of Bushman, Hottentot or Bantu origin or even a mixture of two of them. Some place-names are partly Dutch and partly English, e.g., Robben (seal) Island and Mossel Bay.

Until quite recently there were few towns in South Africa. The native inhabitants were nomads or semi-nomads and fixed settlements were rare. Physical features were of course named, especially mountains, kloofs and rivers, whilst long before Europeans settled at the Cape prominent coastal features had been named, chiefly by the Portuguese. Many of these names were changed later, usually because the newcomers were ignorant of the original nomenclature.

The presence of the Bushmen is recorded by Dutch names like Bosjesmans Kloof and Bosjesmans River. There are a great many Hottentot expressions, especially for topographical features. The termination *-qua* meaning *men of* or *sons of* is frequently found ; e.g. Komaquas Berg (' The Mountain of the Komas '), Hessiquas Kloof, Attiquas Mountains, Outeniquas Mountains, Namaqua-land, Griqua-land. The Hottentot word *daos* or *douw* (poort) is found in Tradouw (the Poort of the Women) and Touws River. Keiskamma (Glistening Water), Tsitsikamma (Clear Water), Tarkastad (the town or ' stad ' of the Maidens' River), Karroo (dry or arid), are other examples.

There are a vast number of Bantu place-names which also refer chiefly to physical features. The following are examples : Amajuba Mountains (Doves Mountain), Amatola (Young Beasts), Quathlamba (Pushed Together), Komati (Cow), Limpopo (Pushing), Umzimkulu (the Great Place), Zambezi (The Great River), Matatiele (ducks have flown), Tsolo (the Pointed Hill), Xalanga (the Vulture), Umtali (River of Metals), Maseru (Red Sandstones), Thaba Bosigo (Mountain of Darkness), Leribe (Undulating), Butha Buthe (Security), Kanye (to strike a sharp blow), Mbabane (crushes out), Gwelo (to climb), Sabi (sand), Hlobane (Place of Contention), Umzinto (Home of Achievement), Thaba 'Nchu (Black Mountain), Kalahari (Desert), Ubombo (Bridge of Nose).

The Portuguese never settled in the present Union of South Africa, so that names of Portuguese origin are only found on the coast. Cape St. Blaize, Cape Recife (the Reef), Cape Agulhas (the Needle, i.e., the compass needle, because here it pointed true north), St. Helena and Saldanha Bay are some of the more obvious place-names commemorating the Portuguese discoverers.

A large proportion of places, of course, bear Dutch names. Words like Nek, Hoek, Ruggens, Krantz, Klip, Kloof, Poort, Berg, Koppie, Tafel, Spionkop, Paard, Spruit, Breede, Zout, Zwarte, Witte, Modder, Zand, Melk, Vis, Zeekoe, Rhenoster, Buffel, Olifant, Duin, Eland, Fontein, Vallei, Vlei, Drift, Kuil, Veld, Bokke, Drooge, Bot, Bosch, Baviaans, Sneeuw, Blaauw, Walvis, are too common to require explanation. Many of these refer to physical features and often they have a special South African meaning. Others refer to animals and plants.

The name of the oldest city has shown several variants. In 1686 it was called Cabo de Goede Hoop and later, more simply, De Caab. The Portuguese

Cabo was still later changed to Kaap, and for long it was customary to speak of the Mother City as De Kaap (the Cape). Still later it became *the* Cape Town, i.e., the only real town of the Cape.

Many towns owe their names to Dutch governors or to their relations or to friends of prominent Dutchmen. Stellenbosch was named after Van der Stel, Swellendam after Swellengrebel and his wife, Graaff-Reinet after Van der Graaff and his wife Reinet. Other examples are Uitenhage, Tulbagh, Elsenburg, Mulders Vlei, Drakenstein, and Riebeeck Kasteel.

During the eighteenth century towns all over the country took their names from the farms which were their original centre. Many places were named after the Huguenots and their descendants. In the next century English place-names became numerous. George, King William's Town, Adelaide, Albert, Prince Albert, Alice and Port Alfred commemorate Queen Victoria and her relations. Governors and their friends are represented by Caledon, Cradock, Clanwilliam, Somerset, Beaufort, Port Elizabeth, Durban, Napier, Maitland, Richmond, Harrismith, Ladysmith, Ladismith, Cathcart, Lady Grey and Darling. Bathurst, Beaconsfield, Carnarvon and Kimberley were named after English statesmen, whilst Wellington received its name after the great soldier.

Bloemfontein probably refers to a spring or river with 'blooming flowers all around.' Pretoria, Johannesburg and Pietermaritzburg are named after great Boer leaders. In the Eastern Province a number of forts were called after soldiers who fought in the native wars. In the same area Berlin, Potsdam, Stutterheim, Hanover, Hamburg, etc., derive their origin from the German Legion which settled there in 1856. British Kaffraria was divided into 'shires' and named after English counties.

It is not surprising that many sites have been called after missionaries and ministers, including some of the Dutch Reformed Church. Hankey, Philipstown, Buxton, Wesleyville, Butterworth, Lovedale, Pirie, Moorreesburg, Herold, Marquard and Lindley are examples. Biblical names are also numerous. Some places are named for quaint reasons, e.g. Koffiefontein (because a few coffee seeds were found in the well), Benoni (Sorrow's Son—because the man who surveyed the place had a hard task), Bethal (Eliz*abeth* and *Al*ida).

7. GEOLOGY.

A. RELATION TO OTHER CONTINENTS.

It has long been recognized that in the remote past Africa was associated with other continents. According to the great Austrian geo-physicist Suess an old continent, Gondwanaland, once stretched from South America towards Australia and Southern Asia; of this ancient continent Africa was a part.

Later geologists, observing, for example, the remarkable parallelism between the shores of Labrador and those of south-western Greenland, and the almost exact congruence of the coasts of Brazil and West Africa, believe that the continents have drifted apart by a process of horizontal displacement. That this may have happened is not incredible, for the rocks of which the continents are mainly composed are somewhat lighter than the basalt upon which the continents rest; hence we may compare the continents to rafts floating upon a sea of plastic basalt. Wegener believes that the triangular shape of South America,

Africa and India may be explained by supposing that these lands, together with Australia, were once part of an extensive Antarctic continent which broke up along radial cracks to form sectors which subsequently drifted northwards.

GEOLOGY.

1, Sand; 2, Cretaceous System; 3, Karroo Volcanics; 4, Karroo Sediments; 5, Cape System; 6, Pilandsberg; 7, Younger Granites; 8, Bushveld Complex; 9, Waterberg System; 10, Transvaal-Nama System; 11, Ventersdorp System; 12, Witwatersrand System; 13, Older Granites and Gneiss; 14, Swaziland System.
(*After* Dr. A. W. Rogers.)

The Wegener hypothesis explains the strange similarities in geological structure between lands bordering the Atlantic and the Indian Oceans, and it accounts for the glacial conditions which are known to have existed in India, Australia and South America; it also explains the astonishing fact, of which there is abundant evidence, that in Carboniferous times South Africa must have been mantled with ice, as Greenland is to-day. It should be understood, however, that the Wegener hypothesis does not offer the only possible explanation of these phenomena.

B. TABLE OF FORMATIONS.

Era. (Probable years in formation)	*System.*	*Stratified Formations.*	*Maximum Thickness.*	*Igneous Intrusions.*
Cainozoic (60,000,000)	Quaternary.	Recent and sub-recent gravels, etc.; raised beaches;	300+ ft.	
	Tertiary.	Marine and inshore beds; Kalahari beds	—	
Mesozoic (120,000,000)	Cretaceous.	Marine beds of Zululand, Pondoland, and Portuguese East Africa	100 ft.	Volcanic pipes and fissures of Kimberlite and basalts.
		Uitenhage Series (Neocomian)	4000+ ,,	
	Karroo (Upper)	Stormberg Series: Drakensberg lavas, Cave sandstones, Molteno beds	8000+ ,,	Intrusion of basic rocks throughout S. Africa.
Palaeozoic (320,000,000)	Karroo (Lower)	Beaufort Series (shales and sandstones)	11,000 ft.	
		Ecca Series (shales and sandstones)	6,200 ,,	
		Dwyka Series (shales and tillite)	3,200 ,,	
	Cape.	Witteberg Series (shales and quartzite)	2,500 ,,	
		Bokkeveld Series (shales, sandstones and marine fossils)	2,500 ,,	
		Table Mountain Series (shales and sandstones) ...	5,000 ,,	Syenite dykes and sills; Pilandsberg.
	Waterberg.	Waterberg Series (shales, sandstones and conglomerates)	5000 ft.	Bushveld Igneous Complex; younger granites of Cape Province.
		Matsap Series (lavas, quartzite, and conglomerates) ...	7000+ ,,	
Archaeozoic ?	Transvaal.	Rooiberg, Pretoria, Campbell Rand and Black Reef Series (Transvaal and Northern Cape).		
		Ibiquas, Malmesbury and Nieuwerust beds (Western Cape)	16,000 ft.	
	Ventersdorp.	Pniel, Kuip and Zoetlief Series (lavas, shales, quartzites, sandstones and conglomerates)	5000 ,,	
	Witwatersrand.	Kimberley, Elsburg, Main Bird, Jeppestown, Government Reef and Hospital Hill Series (quartzites, shales and conglomerates)	25,000 ,,	Basic dykes of Southern Transvaal.
	Swaziland.	Pongola, Kraaipan, Abel's Kop, Kheis and Moodie's Series (lavas, schists, conglomerates, etc.)	25,000 ,,	Gneissic intrusions.

C. GEOLOGICAL HISTORY AND STRUCTURE.

Primitive (Swaziland) Series. The earliest phases of South Africa's geological history are obscure. It is certain that they involved more than one geological revolution, but little is known of the extent of the region involved, or of the origin of the ancient sediments. The similarity between the ancient rocks of South Africa and those of India, Eastern Brazil and Western Australia suggests that mineralization of the invaded strata belongs to the same remote epoch.

After an indeterminate period of erosion the foundation rocks of the sub-continent were buried beneath sediments which, greatly altered by pressure and by granitic intrusions, form the most ancient of our present rock-systems. This *Primitive Series*, known more commonly as the *Swaziland System*, is now exposed here and there along the Atlantic coast region as far as Angola, in parts of Natal, Swaziland and the Eastern Transvaal, and in the neighbourhood of Prieska and Upington. Elsewhere the Primitive Series is overlaid by less ancient rocks.

The scenery associated with the Swaziland System consists of rolling country, with domes, peaks and ridges of bare granite and gneiss ; examples occur in the Murchison Range and in the rugged Barberton Mountain Land. The Primitive Series is entirely devoid of fossils. Indeed, owing to the absence of fossils older than those of Devonian times it has not been possible to relate the archæozoic systems of South Africa with those elsewhere. Hence all pre-Devonian rocks found in South Africa have been given a local nomenclature.

Granites intrusive into the Swaziland System are called the *Older Granites* to distinguish them from granites of more recent age. The Older Granites are greyish-white, the newer red or pink. The greater part of the Transvaal Low Veld and of Swaziland, as well as large areas in Bushmanland and Namaqualand, are occupied by the Older Granites.

Witwatersrand System. This series, composed mainly of sediments, marks the second epoch in the geological history of the sub-continent. The formation consists mainly of ferruginous muds and sands, with pebbles of quartz, chert and porphyry derived from the Primitive Series. It is probable, from the absence of limestone, that these beds were deposited in fresh water ; there is some evidence that the upper beds of the series formed part of a vast delta.

It is usual to distinguish the lower and upper divisions of the series. The *Hospital Hill Series* of slates and quartzites forms the base ; these are succeeded by the *Government Reef Series* of quartzites and auriferous conglomerates, and these by the red slates of the *Jeppestown Series*. The Upper Series consists of the

Main Bird Series and the *Kimberley-Elsburg Series*. The *Main Reef Zone*, part of the Main Bird Series, consists of three successive conglomerate beds, the Main Reef, the Main Reef Leader, and the South Reef; the second of these holds the most payable gold deposits in South Africa. The highest beds of the Witwatersrand System, those of the Kimberley-Elsburg Series, are composed of slates and quartzites; the latter, called the Kimberley Reefs, contain the gold that has been worked near Krugersdorp.

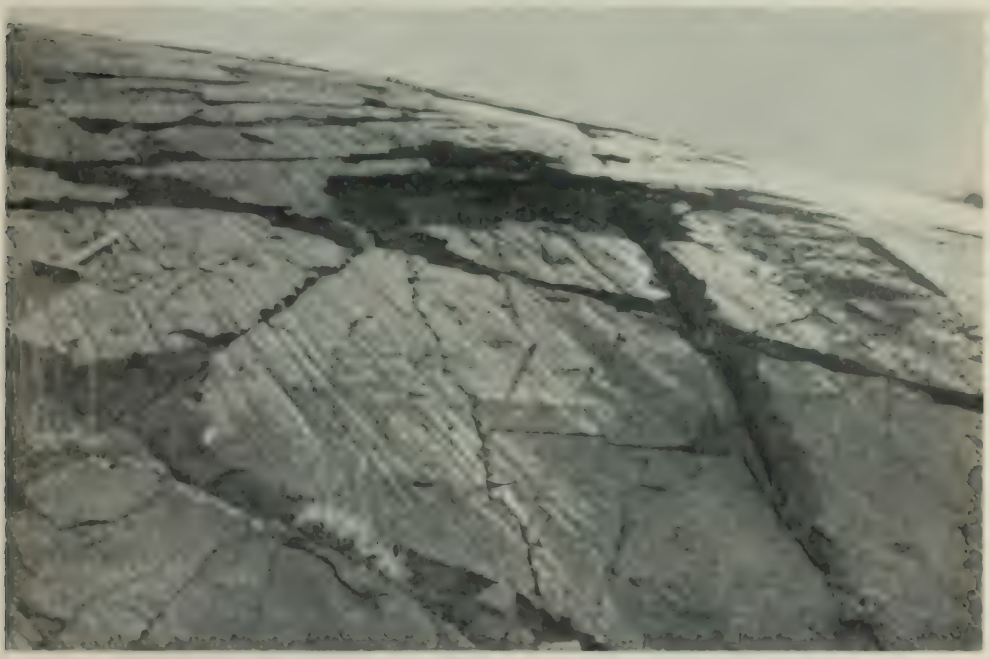


Photo. *A. M. Duggan-Cronin, Esq.*

Glaciated Floor of Diabase (Roche Moutonnée), Barkly West district.

Ventersdorp System. The further deposition of Witwatersrand sediments was terminated abruptly by a period of the most intense and prolonged volcanic activity that South Africa has ever known. The lavas and basalts of the Ventersdorp System occupy an extensive region stretching from Prieska northward to the Dwarsberge; near Ventersdorp the series is 11,000 feet thick.

Throughout the Rand-Parys area the volcanic outpourings overlie the Witwatersrand beds; in the South-West Transvaal and in Griqualand West they cover the pre-Witwatersrand rocks.

During the period of the Ventersdorp eruptions the Witwatersrand area was greatly tilted, but the internal stress having been relieved the region now entered upon an indeterminate period of relative stability.

The base of the Ventersdorp System is the *Zoetlief Series*, exposed in the Prieska-Vryburg area and in the Kimberley shafts.

The upper division, or *Pniel Series*, forms part of the pre-Karroo peneplain in the South-West Transvaal and underlies the valley of the Vaal as far as its confluence with the Orange.

Transvaal (Nama) System. The Ventersdorp volcanic period was followed by a long epoch in which the entire country appears to have been worn down almost to a level plain. The whole of the sub-continent, probably as far as the Congo, then subsided beneath the ocean. The sediments built up during this period of marine submergence form the *Transvaal* (or *Nama*) *System*. A significant feature is the high manganese-content of the limestones : this metal is a constituent of the deep-sea oozes. The Transvaal System, however, contains no fossils.

Except for the Karroo System the Transvaal System is the most widely spread sedimentary group in Southern Africa. In the Transvaal the system comprises the *Black Reef* and the *Dolomite*, *Pretoria* and *Rooiberg Series*. The first-named, composed of quartzites, shales and auriferous conglomerates, contributes to the formation of the Transvaal Drakensberge. The Dolomite Series forms part of the Pietersburg Highlands, but its greatest development is in the western part of the province, where it covers an area of 2,500 square miles. In the Lydenburg district the dolomites yield gold, and elsewhere lead, silver, zinc, manganese and iron ; more important, however, are the immense reserves of water stored in the dolomites of the Vaal-Limpopo watershed.

The Pretoria Series, the most extensive formation of the Transvaal System, surrounds the *Bushveld Complex* occupying the centre of the province ; its shales and quartzites have been much metamorphosed through contact with the igneous rocks of the Complex.

The Rooiberg Series, composed of acid lavas, volcanic tuffs, quartzite and shales, is the uppermost series of the Transvaal System ; in certain areas it forms a roof over the Complex.

In the Northern Cape the Transvaal System is represented by the *Black Reef*, *Campbell Rand* and *Griquatown Series*, corresponding to the Black Reef, Dolomite and Pretoria Series of the Transvaal. These formations enter into the structure of the Asbestos Mountains, the Kaap Plateau, and contiguous areas.

In the Western Cape the *Nieuwerust Quartzites*, resting on Namaqualand gneiss, may be correlated with the Black Reef Series ; the *Malmesbury* and *Cango* beds, consisting of shales, quartzites, slates, limestones and cherts, correspond to the Transvaal Dolomites, whilst the *Ibiquas* and *French Hoek* beds, composed of sandstones, slates, grits and conglomerates, are related to the Pretoria Series. At Sea Point (Cape Town) the penetration of the slates of the Malmesbury Series by granitic material has long provided a phenomenon of great interest,

viz., the formation of a mixed rock (*migmatite*) exhibiting both slaty and granitic characters.

The building up of the sediments of the Transvaal System was followed by a glacial period during which large areas of these sediments became covered with *tillite* (solidified glacial gravel and clays). It is believed that similar formations in Katanga, in South Australia and in India belong to the same epoch.

During or shortly after this period a mass of igneous material forced itself between the Pretoria and Rooiberg Series of the Transvaal System. This norite bed, of such thickness that it caused the Pretoria beds to sag beneath its weight, forms the *Bushveld Igneous Complex*, rimmed with the quartzite ridges of the Pretoria Series. The Great Dyke of Southern Rhodesia was formed during the same period of igneous activity.

Waterberg System. Extensive denudation of the Complex and its covering of Rooiberg beds was followed by the deposition of the sandstones, shales and conglomerates of the *Waterberg System*. There is evidence that these rocks were formed under shallow fresh-water conditions. The Waterberg System contributes largely to the structure of the lofty Palala plateau and the Zoutpansberge. On grounds of rock-composition and stratigraphical position the *Matsap Series* of Griqualand West appears to have been formed at the same period; subsequent folding of these beds produced the Korannaberge and the Langeberge. There was also crustal activity in the Transvaal, in the course of which the Waterberg became folded. The strange ring-shaped Pilandsberg, to the north of Rustenburg, an island-mountain group eighteen miles in diameter, represents a phase of alkaline volcanicity with which the epoch closed.

Cape System. The events just described are presumed to have taken place in Silurian times. Before the close of this period the southern half of the Cape had been worn down to a peneplain traversed by rivers which spread out in vast deltas, depositing unfossiliferous muds and sands brought down from the north, and possibly also from a great tract of land to the west. Thus originated the sandstones and shales of the *Table Mountain Series*, the lowest beds of the Cape System. The sediments were deposited in shallow water, and form an accumulation nearly a mile in thickness.

The Table Mountain Series forms most of the mountains of the Southern Folded Region; the ranges are usually anticlinal folds. The formation is also represented in Pondoland and Natal, where it rests on the older granites and gneisses.

Subsidence during Devonian times brought about a marine invasion and the deposition of the shales and sandstones of the *Bokkeveld Series*, which rests conformably upon the Table Mountain Sandstone. The rocks of this series are the only Cape rocks of

marine origin, and are of special interest in that they are the oldest rocks in South Africa which are definitely fossiliferous; the fauna show affinities with those of the Devonian rocks of the Falklands and of South America. The fertile soils of the South-West Cape are largely the result of the weathering of the Bokkeveld beds. At the junction of the Table Mountain Sandstone and the Bokkeveld shales springs are numerous.

Photo.] [*Dr. A. W. Rogers.*

FOLDED BOKKEVELD BEDS, KLEIN ZWARTEBERGE.

The uppermost beds of the Cape System are the shales and quartzites of the *Witteberg Series*. The absence of marine fossils in these beds points to their lacustrine (fresh-water) origin. The series forms several ranges along the southern border of the Great Karroo.

KARROO SYSTEM. The formation of the Cape sediments was succeeded by the Carboniferous Period, in which not only South Africa but other parts of Gondwanaland were extensively glaciated. It is not definitely known how these conditions were caused, although a possible explanation was suggested at the beginning of this chapter; but the wide distribution of glacial deposits and the scratched and polished surfaces of the older rocks that have been exposed by denudation leave no room for doubt as to the existence of the ice-sheet. Under these conditions was formed the

tillite of the *Dwyka Series*, which forms the base of the Karroo system.

The principal area occupied by the Karroo System is a synclinal basin, somewhat oval in shape, stretching from Karroo Poort to Middelburg (Transvaal) and from Kimberley to East London. Over large areas of this vast region, which covers exactly one-half of the Union, the only rocks exposed at the surface are those of the Karroo System.

Photo.] [*Dr. A. W. Rogers.*

DOLERITE INTRUSION IN BEAUFORT BEDS, BEAUFORT WEST.

The conditions under which these sediments were formed are not exactly known, but the abundance of reptilian remains preserved in them and the absence, except in South-West Africa, of marine fossils, suggest that the Karroo beds were deposited under either lacustrine or shallow fresh-water conditions.

Resting conformably upon the Dwyka tillites are the shales and sandstones of the *Ecca beds*, which in the Cape reach a thickness of 6000 feet. It was in these beds that the coal of Natal and the South-East Transvaal was formed. The coal lies mainly along the eastern border of the Karroo basin, indicating that it was formed from vegetation that grew along the swampy margins of the vast lake in which the beds were being laid down.

The Ecca Series is followed by the shales and sandstones of the *Beaufort Series*, exposed throughout the Great Karroo, the

eastern part of the Orange Free State, the Eastern Cape and the west of Natal. During the formation of this series it is probable that the whole of the Karroo basin was traversed by broad sluggish streams, opening here and there to form extensive swamps. Animal life at this period was abundant. The marshes were the home of ponderous slow-moving reptiles like the *Pareiasaurus*, measuring ten feet in length. The drier areas were inhabited by more agile creatures, some no larger than cats and others resembling horses. It is probable that the Upper Karroo period saw the first appearance of mammals.

It was whilst the upper beds of the Beaufort Series were being laid down that earth movements began which produced the Cape Folds. The great initial elevation of these ranges exposed them to changes of temperature, wind, rain and other destructive agencies, with the result that vast quantities of rock-waste were carried eastwards and northwards to form the *Molteno beds*, which form the base of the *Stormberg Series*.

Coal is found in the Molteno beds from the Stormberge eastwards to the Natal border. The seams seldom exceed a foot in thickness, and since the coal contains layers of silt, having been transported a considerable distance from the region where the coal-forming vegetation grew, the deposits are of little economic value. The coal has also been adversely affected by the doleritic intrusions of the later Stormberg period.

The Molteno beds are succeeded by beds of brilliant red and purple mudstones, shales and sandstones in which *Dinosaurus* remains have been preserved. The *Red Beds*, again, pass upwards into the massive *Cave Sandstones*, which form bold outcrops along the Natal border and in Basutoland. Immense pillars and buttresses are common features ; near their base wind-erosion has fashioned the caves in which at a later period Bushmen have found shelter. At this time conditions were becoming increasingly arid ; from the angular shape of the sand-particles it is probable that the cave sandstones are a wind-blown formation.

The deposition of the Cave Beds was followed by the widespread volcanic activity which produced the dark lavas and basalts of Basutoland, the Central Transvaal and the Lebombo region. These volcanic rocks, known as the *Stormberg Series*, form the precipitous summits of the Maluti and the Drakensberge. Most of the lava was poured out slowly from great fissures ; it is only in Basutoland that eruptions of the explosive or volcanic type occurred, and even here no volcanic cones were built up.

About the close of the Karroo period the Stormberg beds and nearly all those beneath them were invaded by a more or less basic magma which solidified as dolerite ; the Cape Folded Region, however, was practically immune from these intrusions. The dolerite sills and sheets of this period form many scenic features

of the present day, such as the table-topped mountains of the Northern Karroo and the waterfalls of the Eastern Cape.

The foldings of the Southern Cape, initiated during the building up of the Beaufort Series, were continued throughout the Stormberg volcanic episode and the succeeding period of dolerite intrusions until about the beginning of Cretaceous times. There is evidence of simultaneous folding in Natal and Pondoland, but much of this folded area is now buried beneath the sea.

Photo.] [*Dr. A. W. Rogers.*

Outlier of Drakensberg Beds (Stormberg Series) near Matatiele. The white outcrops are Cave Sandstone.

Cretaceous System. During the Jurassic period the southern folded ranges were thrust up so high and the intervening troughs became so deep that drainage assumed an east-and-west direction, whilst the lower parts of the longitudinal valleys were invaded by the sea. As a result of prolonged denudation the valley-floors became covered with sediments and pebbles which solidified into conglomerate, shale and sandstone. These rocks are known as the *Uitenhage Series*, exposed along the Breede River and the south coast, in the Little Karroo, and in the lower Sundays River valley. The coast beds were laid down under entirely marine conditions, and are composed partly of limestone; the intermontane beds contain both plant and marine fossils, and are therefore of mixed fresh-water and marine origin.

The Uitenhage Series is represented in Pondoland, Zululand and Portuguese East Africa. From the evidence of fossil remains it would appear that the period saw a simultaneous flooding of the coastal plain from the southern Cape to India.

The close of Cretaceous times was marked by the formation of pipes and fissures of *kimberlite* throughout a large area. The molten material was derived from various depths, but the chief constituent is olivine. Only a few of the pipes yield diamonds ; it is not known how these gems were formed. It is singular, however, that in colour, lustre and other characteristics the stones yielded by every kimberlite pipe are distinctive : each eruption produced diamonds that are readily distinguishable from those of other eruptions.

Cainozoic Era. The chief feature of this period has been the gradual elevation of the land relatively to the sea. This upheaval has been going on since early Tertiary times, since which period the effective uplift (i.e., the absolute vertical movement minus loss in altitude through erosion) has amounted to about 2000 feet. The doming-up process has given the resultant plateau a cooler climate, but has deprived the country of wide alluvial plains and navigable rivers. The earth-tremors that are of frequent occurrence in the Transvaal, the existence of hot springs, and the formation, in late Tertiary age, of the Pretoria Salt Pan, probably the most southerly of the ' East African ' volcanoes, are evidence that crustal movements are still in progress. The present rate of uplift is perhaps a foot in two centuries.

It is interesting to consider the cause of this upward tendency ; paradoxically, it is due to the continued denudation of the land. It has already been explained that the continents are not stable ; they appear to float upon a heavier sub-stratum. Prolonged wearing down of the surface by rivers results in a deposition of rock-waste upon the ocean floor, which is thereby depressed. At the same time the land-mass, having become lighter, tends to rise, whilst equilibrium is established by a horizontal movement of the plastic magma from below the sinking ocean floor to below the land-mass. Usually these processes are intermittent rather than continuous. (See diagram p. 50.)

Evidences of uplift are to be seen in the marine inshore sediments and raised beaches of Tertiary age occurring at various heights along the south and east coasts of the continent. Some of these beds are at present 1,300 feet above sea-level.

D. PHYSICAL STRUCTURE.

South Africa may be divided into an interior plateau, bounded by an imposing feature known as the Great Escarpment, and the country between the escarpment and the sea. The physical

characteristics of these areas are described on pp. 55-57 ; some geological features remain for consideration.

Plateau and Escarpment. It has already been explained that the sub-continent has a foundation of very ancient sediments and igneous rocks largely covered by beds of sandstone and shale, mostly of freshwater origin, called the Karroo System. The Karroo beds, which as a rule are nearly horizontal, are penetrated by intrusions of dolerite, either in the form of horizontal sheets or as vertical dykes. Except for the broad belt of folded country in the Southern Cape no folding has taken place since the deposition of the Karroo beds, and since the interior plateau has been exposed to denudation throughout long ages of geological time it is not difficult to understand its usually level character.

The base of the Great Escarpment is not a contour line ; generally speaking, the base is higher where the summit is higher. In the Drakensberge, where the feature reaches its greatest height, the volcanic beds of the Karroo System are of great thickness. To the west of the Stormberge only the older rocks take part in the structure of the Escarpment.

The problem of the origin of the escarpment is one of the greatest interest. There is no evidence that the feature was caused by faulting. At some period a watershed must have been established where the volcanic beds were thickest. From this watershed numerous short rivers flowed directly to the Atlantic and Indian Oceans, whilst others flowed northwards and westwards. Owing to the heavier rainfall of the coast region the short rivers traversing this area must have possessed enormous erosive power. The escarpment seems to have been produced by the head-stream erosion of these coastal streams against a gradually rising land. The crest of the escarpment is for the most part composed of horizontal or gently inclined beds, which tend to break along vertical joints ; it is along these vertical joints that the great cliffs of the escarpment have been developed. On this hypothesis it becomes apparent why as a general feature the escarpment is parallel to the coast. The enlargement of the coastal plain between the escarpment and the east coast is explained by the heavier rainfall of this region ; here the streams have greater erosive power than in the west.

The Northern Karroo and the Tableland of the Orange Free State. The greater part of this region is composed of Karroo beds with their dolerite intrusions ; along the north-western border denudation has exposed the more ancient granites. The plains are relieved only by conical or flat-topped hills and by long ridges formed of dolerite outcrops. In the drier areas there is

much surface limestone, and except in the valleys the soil is thin. In the shallow valleys of the Northern Karroo there are numerous broad clay-flats known as *vloere*. An interesting feature is the abundance of shallow depressions called *pans*, occupying a belt extending from the Northern Karroo as far as Lake Chrissie. There are good reasons for supposing that these pans were formed at a time when the present drainage systems had not been evolved, and when the climate was more arid than at present. Prolonged erosion, during a period when crustal movements were not taking place, must have produced an extensive plain in whose slight hollows occasional accumulations of water would soften the underlying rock ; the resultant clay dried into a powdery soil which the strong winds of this epoch soon blew away. It has also been suggested that pans may have been formed, or at least deepened, through the removal of muddy water by herds of animals in the course of drinking and wallowing.

The Basuto Highlands. These greatly-dissected highlands, the most impressive mountainous feature of South Africa, are formed of the sandstones and basaltic flows of the Upper Karroo System. The base of the volcanic beds is seldom less than 5000 feet above sea-level ; the crests of the escarpment rise from 2000 to 6000 feet above this base. The volcanic material consists mainly of finely-grained lava. The individual lava-flows vary in thickness from one foot to over a hundred feet, and since their surfaces show little weathering the successive flows could not have been separated by long intervals.

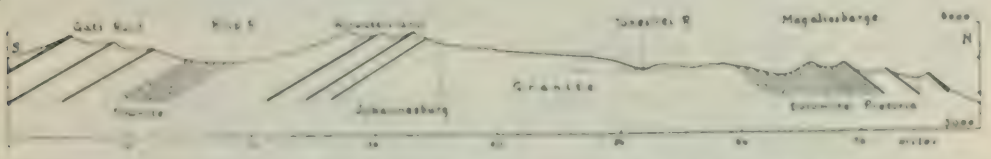
The Kaap Plateau. It is customary to include in this region not merely the limestone plateau extending from the Harts-Vaal valley to the Asbestos-Kuruman highlands but also the Langeberge and the Korannaberge, which mark the south-eastern border of the Kalahari. The banded ironstone of the Lower Griquatown Series contains vast deposits of crocidolite or blue asbestos. Reserves of manganese ore to the north of Postmasburg are estimated to exceed 20,000,000 tons. Limestone worked near Taungs yields lime and cement.

The Transvaal High Veld. This region consists mainly of nearly horizontal Karroo beds penetrated by extensive sheets of dolerite. Near the northern edge denudation has exposed the Witwatersrand and other ancient rocks.

Economically the High Veld owes its importance to the auriferous conglomerates of the Witwatersrand System and the coal deposits of the Karroo beds. Not all the conglomerates (or *bankets*, from their resemblance to an almond sweetmeat for which banket is the Dutch word) are sufficiently auriferous to warrant exploitation under present economic conditions ; the most payable strata are

those of the Main Reef Zone. The reefs strike east and west and dip southwards, and are being worked at depths varying from a few feet to 7,500 feet.

The question of where the gold originated has long interested geologists. The 'placer theory,' which is most widely accepted, supposes that the gold-particles were mechanically deposited, along with pebbles, as the result of the denudation of pre-existing gold-bearing rocks. Another explanation is the 'infiltration' or 'impregnation' hypothesis, by which gold, quartz and other substances are believed to have been introduced into the pebble beds in the form of solutions.



DIAGRAMMATIC SECTION FROM THE GATS RAND ACROSS THE WITWATERSRAND TO THE MAGALIESBERGE.

The more prominent escarpments, shown by heavy lines, are formed by beds of quartzite.

(*After* Professor J. H. Wellington.)

The coal-measures of the Witbank district are the most important in the Union. Here there are some five or six seams, having a total thickness of fifty-seven feet, lying horizontally one over the other. The coal is fairly hard, and can thus be worked and transported without waste. Reserves in the Witbank area total 8,000 million tons.

The alluvial diamonds of the South-West Transvaal occur in gravels laid down by an ancient river, of which the Molopo is probably a survival, that traversed the area from north-east to south-west. In the Lichtenburg district the stones are exceedingly numerous but of poor quality. The Premier mine is the most easterly of the kimberlite occurrences worked in South Africa.

THE TRANSVAAL MIDDLE VELD. Over much of this region the removal of Karroo beds has exposed the landscape of Carboniferous times. Karroo rocks are infrequent except as outliers, *e.g.*, in the Springbok Flats, where they cover the igneous extrusions. Great quantities of water are stored in the fissures and cavities of the dolomite region extending from Pretoria to the western boundary and beyond.

The Bushveld Igneous Complex has already been described. Another interesting feature is the Pretoria Salt Pan, a volcanic neck 400 feet deep and two-thirds of a mile in diameter. The rim is composed of granite probably thrown up by the volcano. The bed of the pan, which holds water after rain, consists of

muds and clays of unknown depth. Salt and sodium carbonate are obtained from water pumped to the surface.

The Limpopo Highlands. The principal orographic features of this rugged region are the bold escarpments formed by the red and purple sandstones and quartzites of the Waterberg System. Shales and conglomerates also occur, whilst peculiar bare granite domes, suggesting a landscape of very mature aspect, are a common feature. The Waterberg Highlands, rising in the Palala plateau to 5,900 feet, descend by undulations to the Low Country. The Zoutpansberge consist of parallel ridges caused by extensive faulting. Rivers rising in the Vaal-Limpopo watershed have cut magnificent gorges through the Transvaal Drakensberge and the Limpopo Highlands.

The Transvaal Low Veld. This region is composed largely of archean rocks overlaid by Karroo sediments, basalts and lavas. The ancient rocks often protrude through the more recent sediments to form island-mountains and granite *tors*. The weathering of the granite has produced a surface-covering consisting largely of sand, supporting a plant-growth of poor bush. Agricultural possibilities are limited mainly to alluvial patches along the rivers. The region to the north of the Zoutpansberge is honeycombed with ancient copper workings, the ore having been smelted on the spot.

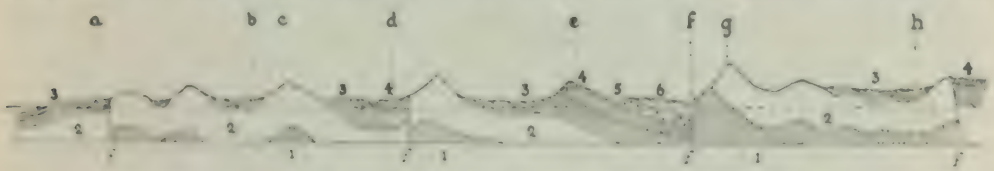
The Great Karroo. The principal rocks of this area are those of the Beaufort Series, whose almost horizontal beds rest upon those of the Ecca Series, which are exposed along the southern and western margins. The valleys are filled with fertile alluvial soils, but over large areas the rocks are bare, or covered only with thin soil. There are legions of dolerite sills and dykes ; this rock affords a hard cap, sometimes hundreds of feet in thickness, protecting the underlying sandstones. Such dolerite-capped hills are the principal surface-features.

The South-Eastern Region. This region is also part of the Karroo basin ; most of the rocks exposed are those of the Beaufort Series, which beyond the Great Fish River reach the coast. Massive sandstone beds and thick sheets of dolerite form imposing terraces, deeply trenched by numerous rivers. Coal is worked in Natal from the Ecca beds and in the Eastern Cape from the Molteno beds.

The Southern Folded Region. The earliest of these folds are those trending north and south in the Cedarberg region. At a later date thrusting from the south against the rigid Karroo block produced the mountain ranges that border the Little Karroo. Most of the valleys are synclinal ; the ranges are anticlines. Eastwards the coast cuts diagonally across the folded

belt, which near the Guatana River disappears beneath the sea. Between Ceres and Bredasdorp the conflict between the Cedarberg folds and the Zwarteberge has produced folds trending north-east and south-west, *e.g.*, the Hex River Mountains.

Coastline. The simple outline of the sub-continent presents complex problems. To study its evolution we have to go back to about the middle of the Cretaceous period, when crustal movement on a tremendous scale resulted in the disruption of Gondwanaland, either by horizontal displacement or through the submergence of large parts of that continent. It is significant that the main outline of Southern Africa developed along lines parallel to the great folds: we may imagine that the troughs



Section through the Cape Folded Belt from Stanford to Triangle. Length. 85 miles.

1, Malmesbury Series; 2, Table Mountain Series; 3, Bokkeveld Series; 4, Witteberg Series; 5, Dwyka Series; 6, Ecca Series. a, Stanford; b, Caledon; c, Attaquas Mountains; d, Genadendal; e, Bosjesveld Berg; f, Worcester Fault; g, Langeberge; h, Triangle; *f*, fault.

(*After* Dr. A. L. du Toit.)

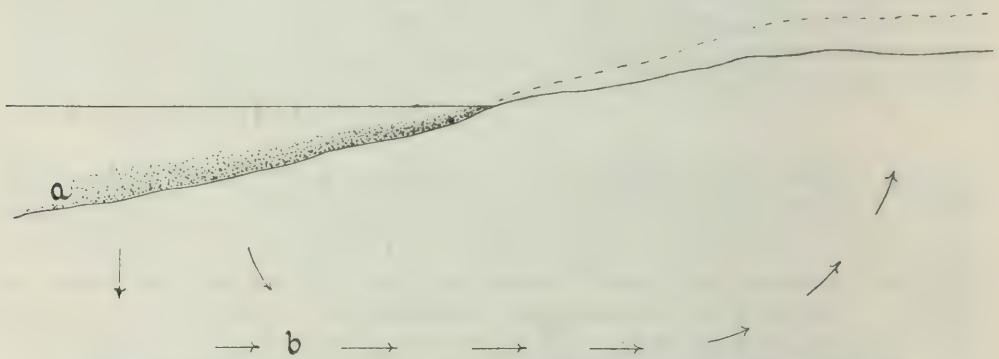
bordering these folds were lines of weakness along which Gondwanaland became disrupted. Thus were formed the primitive South Atlantic and Indian Oceans; in the Upper Cretaceous period the latter washed the base of the Lebombo.

The Tertiary period was marked by prolonged denudation and consequent uplift, by which the area of the continent became considerably enlarged, especially southwards and westwards. The existence of raised beaches and marine inshore deposits at different levels along these coasts suggests that the retreat of the ocean was intermittent. The southern extremity of the African continent at this period is marked by the present extremity of the Agulhas Bank.

It is possible that the emergence of the sea-bed was assisted by an actual change in the ocean level occasioned by the withdrawal of water to form ice-sheets during the Pleistocene period. When the ice melted the ocean returned to its former level and drowned much of the shelf.

Little modification of the coastline has occurred in recent times. The harder rocks have resisted the onslaught of the waves and form capes; the softer rocks, like those forming the synclinal valleys of the Folded Region, have been eroded to form wide bays. On the other hand, sand carried by winds and currents has tended to obliterate irregularities in the shore-line.

South-West Africa. The most ancient rocks of this area are older granites, gneisses, and altered and intensely folded sediments. These formations are exposed in the Kaokoveld, in the south of Great Namaqualand, in that part of Damaraland extending from Rehoboth to Grootfontein, and in parts of the coast region. Many of the mountains of these areas are built of the older granites. Among the ancient rocks are found ornamental stones such as marble, coloured quartzite and blue phyllite, as well as beryl, copper and tin.



a, Sediments deposited on the ocean floor, thus increasing the pressure on the underlying magma.
b, Movement of magma, causing uplift of the land-mass.

The fundamental rocks are followed by the conglomerates, shales and red sandstones of the Konkip Series, exposed in a small area between the Orange River and the Tsaris Mountains.

The sediments of the Nama System, resting unconformably upon the folded Konkip Series, are widely distributed. Their almost horizontal beds, which, except for faulting, have been little disturbed, form extensive plateaux and bold escarpments.

The Karroo System is represented by the Dwyka and Ecca Series and by the Stormberg lavas, exposed between the Orange River and Kalkfontein, between Keetmanshoop and Mariental, and north of the Ugab River. The scenery is Northern Karroo in character, the period having been marked, as elsewhere in South Africa, by intrusions of dolerite.

Tertiary and recent sediments cover two-fifths of the entire area. The sand-dunes of the Namib have been produced by erosion of the surface rocks by violent summer winds from the south-south-west. Near Lüderitz and again north of Swakopmund the rock-waste is coarser in quality and the desert is of rubble rather than sand. The eastern region bordering the Kalahari has a surface of red sand. Recent formations include also a vast area of surface limestone, probably of fluviatile origin, occupying the south-eastern corner of the territory.

The Kalahari. The surface covering of this region consists of a thick mantle of fine red sand. The coloration is due to a film of iron oxide covering each grain; in the neighbourhood of water the sands are usually white. Outliers of Karroo rocks suggest that these beds underlie the more recently-formed sands, but except along the borders, where the superficial deposits are thinner, Karroo rocks seldom show above the surface. The Kalahari sands are of post-Cretaceous date, and were probably laid down when the region stood at a much lower level than at present. In certain areas the surface consists of bare rock, in

Photo. | | *Dr. A. L. du Toit.*

Pan near Serowe, Bechuanaland.

the form of calcareous tufa, sandstone, or recent quartzite, the last-named being derived from sandy salt-impregnated muds. There is little surface drainage, human settlement being concentrated at the numerous pans and water-holes. The Makarikari is a recent feature due probably to earth-movements interfering with the flow of the Okavango River either to the Limpopo or to the Zambezi.

E. ARCHAEOLOGY.

It is reasonably certain that South Africa was invaded successively by various primitive peoples in different stages of cultural development. Moreover, since the sub-continent has no outlet except to the ocean, there has been some congestion of widely-different racial types. Evidence of this fact is to be found in the varied and hybrid character of the culture-relics that have accumulated.

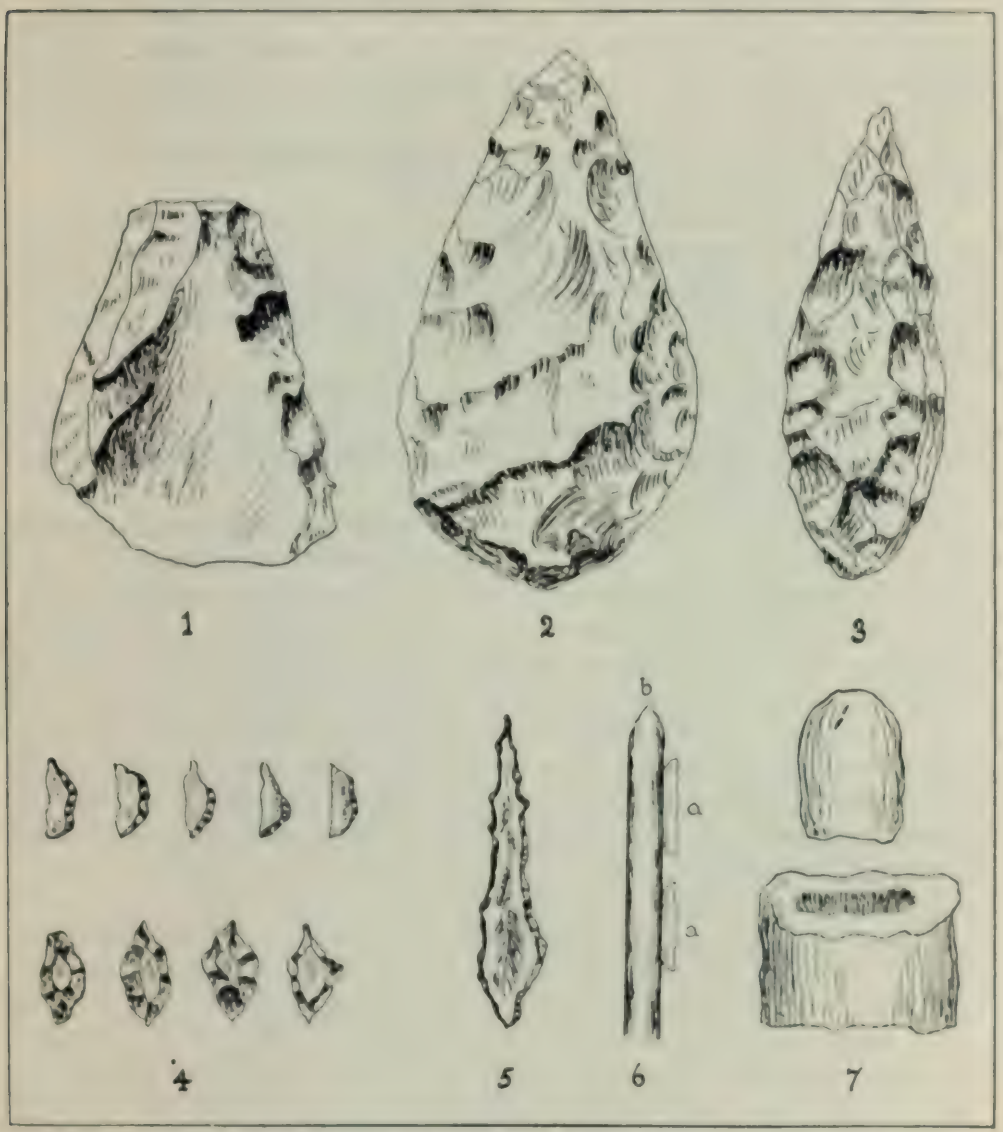
It is also evident that human occupation of South Africa is of great antiquity. Implementiferous gravels near the Victoria Falls have yielded stone cleavers that must have been in use when the river flowed some hundreds of feet higher than at present. Further, implements and human remains have been found in association with animal species that are now extinct.

Although the 'industries' of pre-historic man in South Africa resemble those of Europe, no similarity in age may be inferred. The extraordinary wealth and abundance of archæological material found in this country and its extreme scarcity in Europe suggests that industries that in South Africa date back a mere few hundred years may have flourished in Europe many thousands of years ago.

An *industry* is a collection of implements, all of the same period, preserved in any locality; it is usually named after the place where the implements of the industry were first found. Always remembering the greater modernity of South African culture-epochs, the Stone Age of the sub-continent may be summarized as follows:

Culture.	*Industry.*	*Implements, etc.*
Later Palaeolithic (but probably not equivalent to the Upper Palaeolithic of Europe)	Smithfield ...	Implements in immense variety and number, including scrapers, trimming stones, awls, blades, pestles and mortars; some are polished, suggesting Neolithic man.
	Wilton ... ... (near Grahamstown)	Needle-like tools and crescents, usually of quartz—an intractable material implying considerable skill on the part of the workers. Some of the flakes have keen edges, and appear to have been used with a handle—the ancestral knife. Other relics include digging stones, suggesting primitive agriculture.
Middle Palaeolithic	Still Bay ...	Blades pointed at both ends, probably fastened to wooden hafts and used as lance-heads.
	Glen Grey ... (near Queenstown)	Pointed flakes, discs, scrapers, sharpened pebbles, delicately-made chopping tools; the workmanship suggests Neoanthropic man.
	Fauresmith ...	Various implements of fine workmanship, usually of indurated shale.
Lower Palaeolithic	Stellenbosch .	Breaking and scraping tools, usually of quartzite; primitive weapons.
	Victoria West	Heavy chopping tools and cleavers, usually of dolerite; beak-shaped implements. The considerable weathering to which these implements have been exposed suggests great antiquity.

The antiquity of the Wilton and Smithfield peoples can hardly be surmised, but they were still in existence in the early days of European occupation. Smithfield man was responsible for many



1, Cleaver, Stellenbosch industry; 2, Coup de poing, Fauresmith industry; 3, Lancehead, Still Bay industry; 4, Crescents and double-crescents, Wilton industry; 5, Awl, Wilton industry; 6, Knife: *a*, crescents, *b*, haft, Wilton industry; 7, Pestle and mortar, Smithfield industry.

of the rock-engravings and paintings commonly described as 'Bushman' drawings. These art-forms were executed over a long period of time; in many of the caves figures have been painted over figures drawn perhaps hundreds of years earlier. The paintings show a fairly definite chronological order, with a marked

development in respect of motif, colour and technique. The pigments were derived from minerals found locally ; gum, *Euphorbia latex* and animal fat appear to have been used to make the paint waterproof.

The most recent remains of pre-historic man in South Africa are those of the Kitchen Middens of the coast region. These consist of enormous heaps of implements, pottery, shell-fish remains and miscellaneous rubbish. Kitchen-midden folk have come to be known as *strandlopers* (beach-roamers) ; their skeletons indicate Bushman and Hottentot types.

The Bushman affords an example of the persistence of paleolithic conditions into modern times ; but the present Bushman population is but a remnant of a race that was once widely distributed, and their mode of life to-day throws little light upon Bushman culture.

Except for the bronze-workers of Rhodesia, who were probably not indigenous to Africa, there has been no bronze-age in South Africa ; the coming of the Bantu marked an abrupt transition from stone to iron.

Certain notable anthropological discoveries have been made in the sub-continent. The skull of *Homo capensis*, found in 1913 near Potchefstroom, belongs probably to the Upper Palaeolithic period. Another interesting discovery was that of *Homo rhodesiensis* in 1921 ; the enormous overhanging eyebrows and the receding forehead indicate a type more primitive than the Neanderthal race of Europe. *Australopithecus africanus*, found near Taungs in 1925, represents a form intermediate between the most advanced anthropoids at present in existence and the Java ape-man, probably the most primitive human being known ; the period is late Pliocene or early Pleistocene.

SOUTHERN AFRICA.

CHAPTER I.

STRUCTURE AND RELIEF.

Southern Africa, i.e., Africa south of the Congo-Zambezi Divide, has simple structural features. The whole region is very similar in structure to the Deccan, Western Australia and Brazil. As in these countries, the plateau drops sharply to a narrow coastal plain. The coast is remarkably smooth ; it is devoid of deep inlets, is generally rocky and inhospitable, and possesses few island groups. The plateau structure of the sub-continent, the regularity of the coastline, and the absence—except in the extreme south—of a wide continental shelf have exerted a great influence over the lives of the inhabitants.

The plateau is not smooth, but has been trenched by rivers carrying away, in flood season, much material, so that they have bitten into the higher land to a considerable depth, dividing the tableland into massive blocks. The plateau has an outer higher rim and slopes down towards the interior.

Southern Africa, although geologically old, has not reached complete stability. This is shown by the occasional occurrence of earth tremors, and by the existence of mineral and thermal springs. Over 70% of these springs have medicinal value. The springs of Malmesbury, Goudini Road, Worcester, Montagu, Aliwal North, Warmbaths and Windhoek are important examples.

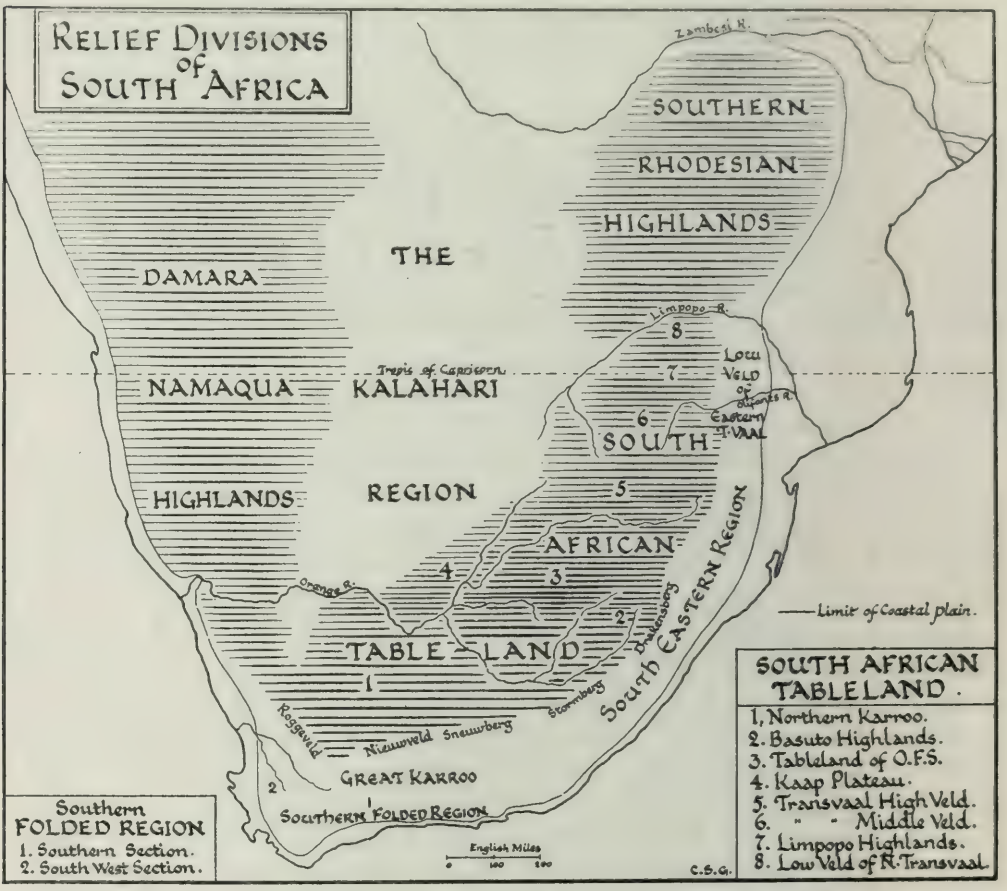
It may be noted that South Africa lacks large bodies of fresh water. The largest fresh-water lakes in the Union are Lake Chrissie and the Klein River Lake, near Hermanus. Salt pans are numerous—those of the Northern Kalahari are of vast extent ; but they do not contain water throughout the year. The poor rainfall of the sub-continent may be attributed in part to the comparative lack of inland water.

The main physical divisions of Southern Africa are (1) the interior plateau with its encircling rim, (2) the coastal region. These may again be divided into minor regions.

Plateau and Escarpment. This great irregular table-land has dominated the life and development of South Africa to an extent that can scarcely be exaggerated. Its inaccessibility, before railways were constructed to exploit its rich mineral areas, retarded

development; its altitude carries a temperate climate into latitudes which are usually unsuited to white races; its clear, bracing air gives its inhabitants a fine physique.

The Escarpment. So important is the plateau rim as an economic and human barrier that it will be well to describe it in some detail. From the coastal side it often appears as a well defined mountain range, a massive rampart whose sides are scoured and



gashed by deep gorges. It can be traced in Southern Rhodesia, north of the wide Limpopo valley. South of the Limpopo River, as the Transvaal Drakensberge, it runs roughly parallel to the east coast. In Mount Anderson, near Lydenburg, it reaches a height of nearly 8,000 feet, and from its crest the plateau slopes gradually down to the High Veld on the west. The eastern face is here precipitous, though between Carolina and the Natal Drakensberge the descent to the low country on the east is more gradual.

In Northern Natal and Basutoland the escarpment attains its loftiest heights, and for a considerable distance it forms a provincial boundary. In the early days this massive wall was a formidable

barrier, though it is now crossed by lines of railway which link the interior to the coast.

To the south-west of the Natal Drakensberge the escarpment diminishes somewhat in height, and for about 400 miles it takes a westerly course, being known in different parts as the Stormberge, Sneeuwberge, Nieuwveld, Komsberge, and Kamiesberge. From the Sneeuwberge to the Nieuwveld Range it forms the northern buttress of the Great Karroo, to which it presents a front whose

Photo.] [*S.A.R. Publicity Department.*

The Great Escarpment, Eastern Transvaal.

maximum height is about 3,500 feet. From the Komsberge it turns north-west and is known as the Roggeveld. In South-West Africa it forms the steep western edge of the great plateau block.

The Escarpment as a Watershed. It is important to notice that from Carolina in the Transvaal to Calvinia in the Cape Province the plateau edge forms the main watershed of the country, dividing the rivers flowing to the Indian Ocean from those flowing to the Orange River and thence to the Atlantic. The shorter streams flowing to the Indian Ocean traverse very broken country and have steeply-graded beds. Moreover, especially in the east, they flow through a region with a moderately heavy rainfall. They are thus eating back into the escarpment at a fairly rapid rate and gradually reducing the area of the Orange River basin.

Physical Divisions of the Plateau. The great triangular land mass of Southern Africa is divided into massive blocks by three great river-systems—those of the Zambezi, Limpopo and Orange. The physical map clearly shows three main lofty highland areas partially enclosing a region of lower elevation known as the Kalahari (see sketch-map). These are (A) The South African Tableland; (B) The Highlands of Northern and Southern Rhodesia; (C) The Damara-Namaqua Highlands.

(A) The South African Tableland.

This may be conveniently sub-divided as follows:

(1) *The Northern Karroo Region.* This is an upland region standing at an elevation of 4,000 feet and stretching from the escarpment northward to the Orange River.

The strata lie almost horizontally and have been penetrated by volcanic rock (dolerite) which in the remote past was thrust up from below to form dykes and igneous sheets. Denuding agents have worn down the land almost to a plain. Scattered koppies relieve the gently undulating surface and are outstanding features of the landscape. There are numerous table-topped hills such as Tafel Berg, near Richmond, rising in isolation from the plain. These are usually due to a cap of hard, resistant dolerite or particularly hard sandstone, protecting the rock beneath from erosion. Where the capping of hard rock has been much reduced, a symmetrical, conical hill, called a spitz-kop, results. There are many of these in the Northern Karroo; some have had their protective cap worn away, and are being gradually reduced to the level of the plain.

Another interesting feature of the Northern Karroo is the large number of slight depressions called pans. Verneuk Pan, with an area of over one hundred square miles, is the largest. During the rainy season these pans hold water, but during the dry season they are monotonous flats which are being made larger by wind action.

(2) *The Basuto Highlands.* Although there is no evidence of folding, the Basuto Highlands are the loftiest part of South Africa. Structurally the area is divided into two parts: the lower western part, composed mainly of sandstone, and the higher volcanic eastern portion. The volcanic area forms the larger part of the country; its eastern escarpment is the mighty wall of the Drakensberge, which here forms the boundary between Natal and Basutoland. In the north-east corner of Basutoland is the great rock mass of the Mont-aux-Sources, 11,170 feet above the sea. Here four rivers take their rise and radiate towards the four points of the compass. As these streams descend they are frequently hemmed in by precipices of yellow sandstone crowned with

dark cliffs of basalt. In one place, at the Malutsinyane Falls, there is a sheer drop of 630 feet. In this lofty region of rocky hills and wild, desolate valleys, vegetation is scanty. Frosts are very severe in winter and under the action of frost and snow the volcanic rock disintegrates, and the valleys are strewn with débris. South of Mont-aux-Sources rise Giants' Castle and Cathkin Peak, both nearly as high as Mont-aux-Sources. The western edge of the volcanic area of Basutoland seen from below has the appearance of a mountain range and is known as the Maluti, which in Mount Machacha reaches a height of nearly 11,000 feet.

(3) *The Tableland of the Orange Free State.* This is a high inland plain with a general elevation of from 4,000 to 5,000 feet. For miles in all directions the flatness of the country is relieved only by an occasional koppie or a line of hills. The Orange Free State is highest in the east and slopes northward and westward to the Vaal, which receives as tributaries the Riet, Modder, Vet and Zand, Valsch and Wilge. During the summer rains these streams bring down a considerable quantity of water, but in the dry winter season they become mere strings of pools.

(4) *The Kaap Plateau.* This is a Karst-like region of porous limestone and underground drainage extending west of the Harts River to the south-eastern part of the Kalahari. Along the foot of its western edge small springs give rise to intermittent streams. The low rainfall of this limestone area, together with the nature of the rock composing it, causes the surface to be exceedingly dry.

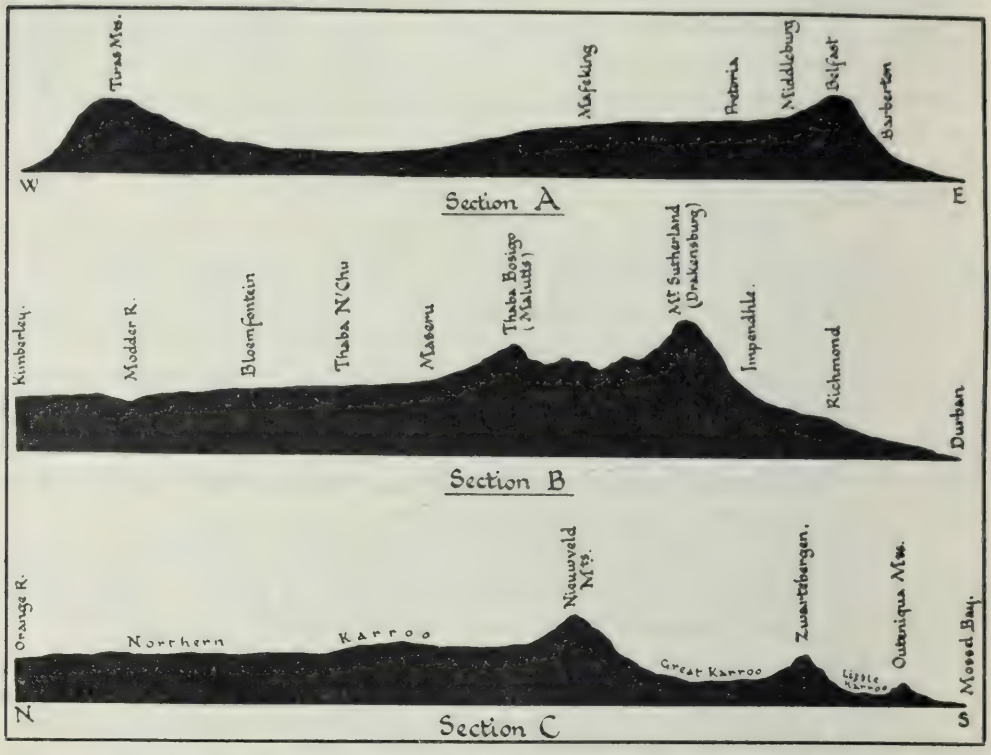
(5) *The Transvaal High Veld.* This includes most of the Southern Transvaal. It extends from the Drakensberge to the western side of the province, and northward as far as the Magaliesberge. The region is nowhere below 4,000 feet in height and in parts rises to 6,000 feet. It consists of undulating grassy plains.

(6) *The Transvaal Middle Veld* lies between the High Veld and the Limpopo Highlands. It is much cut up by streams flowing to the Limpopo River.

(7) *The Limpopo Highlands.* In the north of the Transvaal is a watershed which sends streams to the Limpopo. It includes the Waterberg and Pietersburg Highlands, with the detached Zoutpansberge further north. The Waterberg is a block of rugged country. The Pietersburg Highlands are more undulating, the country resembling the High Veld. The Zoutpansberge consist of a series of nearly parallel ridges.

(8) *The Low Veld of the Northern Transvaal.* Beyond the Limpopo Highlands and extending into Southern Rhodesia is a stretch of country under 3,000 feet in height. On the Transvaal side of the river, streams from the Limpopo Highlands and the Drakensberge flow to the Limpopo. Shrubs and thorn thickets

cover most of the country; hence it is often called the Bush Veld. Similar country is found in the Eastern Transvaal between the Drakensberg escarpment and the Lebombo Mountains. This part, however, receives more rain than the Northern Transvaal.



(A.) Section across South Africa from the Atlantic to the Indian Ocean, approximately in the latitude of Pretoria, showing (1) the Western slopes, (2) the Damara-Namaqua highlands, (3) the Kalahari depression, (4) the South African tableland, (5) the Eastern escarpment, (6) the Eastern coastal plain.

(B.) Section from Durban to Kimberley, in a straight line, showing the High Veld of the Orange Free State, the plateau of Basutoland enclosed by the Maluti and Drakensberg ranges, and the coastal region of Natal.

(C.) Section along Long. 22° E., from Mossel Bay to the Orange River, showing the three Karroos buttressed by intervening ranges to form a succession of terraces.

Rivers. In the South African Tableland which has just been described rise the Orange River and the Limpopo, and it is by way of these rivers that nearly all the drainage from the plateau finally reaches the ocean.

The Orange River System. A glance at the map shows at once the enormous area of the Orange River basin. The river with its tributaries drains a large part of the South African Tableland. Its length is over 1,100 miles, but it suffers from the typical drawbacks of South African streams: varying volume, rapids and falls separating fairly level stretches, and a sand-silted mouth.

It is thus of no use for navigation, and although it traverses almost the entire width of the sub-continent, it has played no part as a highway in opening up the plateau, and merely serves to mark political boundaries.

The Orange rises high in the Drakensberge, behind Mont-aux-Sources. In the first part of its course it flows through Basutoland and is joined by many tributaries. A few miles beyond Aliwal North it receives the Caledon, which also rises in Basutoland, and

Photo] [*S.A.R. Publicity Department.*

Orange River, Aliwal North.

whose valley-floor is remarkably fertile. The most westerly of its perennial tributaries is the Vaal, which rises in the eastern part of the Transvaal High Veld, near Lake Chrissie; and, although it discharges a good deal of water into the Orange during the wet season, its volume is variable.

Below its confluence with the Vaal the Orange traverses country of very scanty and uncertain rainfall, and from Prieska to the Atlantic it receives very little water from its tributaries, though on the map these appear to be of great length. The longest tributary from the south is the Hartebeest, formed by the junction of the Fish, Zak and Olifants Vlei Rivers. Over considerable periods their beds are dry, and the vleis along their courses are seldom more than a few inches deep. The tributary on the north is the Molopo, formed by the Nossob, Molopo and Kuruman Rivers. These again can hardly be called feeders of the Orange,

for their channels are choked by drift-sand, and the small quantity of water they carry is usually diverted by lines of dunes to ' pans ' among the sand hills.

Below the confluence of the Hartebeest with the Orange occur the Aughrabies Falls, where the river drops 450 feet into a narrow granite gorge. It now winds in a deep bed through desolate, uninhabited country of a very rocky and broken nature, and enters the Atlantic Ocean as a sluggish stream, whose mouth is merely a wide expanse of mud flats, interspersed with low islands, with here and there long, lagoon-like stretches of water. A sandbar stretching from bank to bank closes the mouth of the river for several months at a time. The fact that, 28 miles from the mouth, the bed of the river is fordable, emphasizes in striking fashion the shrinking volume of the stream in its lower reaches.

Unlike the Zambezi, the Orange meanders over only a narrow coastal plain, and much of the vast amount of alluvium carried by the river during flood seasons is deposited on the narrow continental shelf. Thus the Orange does not play the part of a Nile to South Africa.

The Limpopo River. The Limpopo has scooped out from the plateau a wide and deep valley which separates the Rhodesian Highlands from the South African Tableland. The Limpopo rises in the Transvaal High Veld, its numerous head streams flowing down the northern slopes of the Witwatersrand, and cutting through the Magaliesberge in poorts. For a long distance the Limpopo forms the boundary of the Transvaal; where it enters Portuguese territory its course is broken by the Tolo Azime Falls. It now takes a south-easterly direction, and, after flowing through the unhealthy coastal belt, it enters the Indian Ocean through a gap in a line of sand-hills to the north of Delagoa Bay. The main tributary of the Limpopo is the Olifants, which breaks through the Drakensberge in an independent valley and, after traversing the eastern low veld and cutting through the Lebombo Range, joins the main stream about 150 miles above its mouth.

The Limpopo is not so steeply graded as the Orange, but its course is broken in places by falls, and, though in summer it brings down a vast volume of water, in the winter it shrinks to an insignificant stream.

(B) The Highlands of Northern and Southern Rhodesia.

The Rhodesias are a continuation of the South African Tableland, and though not so lofty are remarkably similar. Igneous intrusions and outpourings cover great areas; denudation has worn away the softer sedimentary horizontal strata, leaving the harder rock upstanding as koppies.

In Southern Rhodesia a broad and lofty ridge extending from the south-west to the north-east dominates the plateau. In the latitude of Salisbury this higher land runs eastwards to join the Inyanga Highlands, which with the Udzi and Melsetter Highlands form the eastern scarp of the plateau. The drop to the lowlands of Mozambique is precipitous.

Northwards and north-westwards of the main ridge the country is drained by long tributaries of the Zambezi. These streams are carving the plateau into huge blocks, as well as forming spacious plains. Eastwards and southwards the Limpopo and Sabi tributaries dissect the plateau.

Northern and Southern Rhodesia are separated by the Zambezi. Most of Northern Rhodesia is a huge plateau sloping southwards from the Congo-Zambezi watershed. The surface is comparatively level, and in the rainy season huge swamps are formed near the rivers. In the north-east the plateau nearly everywhere exceeds 4,500 feet in altitude, except in the very long and narrow trench drained by the Luangwa and in the Bangweulu and Mweru depressions. North and west of the Muchinga Mountains the drainage is to the Congo. The eastern boundary follows the crests of the Nyasaland Highlands.

(C) The Damara-Namaqua Highlands.

On the east these highlands sink gradually to the Kalahari, and on the west they fall by terraced country to the arid coastal strip that fringes the Atlantic Ocean. In the neighbourhood of Windhoek is a block of high country consisting of rugged ranges of granite, in which a number of periodic streams take their rise, the chief being the Swakop, Kuiseb, Nossob, and Great Fish. South-east of Walvis Bay stretches the bare tableland of the Homs Plateau with its southerly extension, the Huib Plateau, while to the south-east of Keetmanshoop rises an isolated block known as the Great Karas Mountains. To the east and north-east of the Homs Plateau extends a sandy plain which merges with the Kalahari. Towards the Orange River the country becomes much broken up, and is composed of bare hills and ridges among which are desolate ravines. The same broken type of country appears in Namaqualand to the south of the Orange River.

The Kalahari Region. The section drawn across South Africa from west to east in the latitude of Pretoria shows clearly the relatively depressed character of the Kalahari, partially enclosed by the highland regions described above.

The area is a great plain between 3,000 and 4,000 feet above sea level. In the south and south-west it is covered with sand which is frequently thrown into long parallel dunes. It is for the most part an area of inland drainage.

The principal stream is the Okavango, which rises in the Angola Highlands and flows into the reed-choked Okavango swamp. The overflow from this swamp on the north reaches the Zambezi by way of the Chobe swamp; that from the south overflows into Lake Ngami, from which the Botletle River feeds the Makarikari salt pans.

The Country between the Ocean and the Great Escarpment.

The country between the ocean and the escarpment of the interior plateau includes the Coastal Plain, the Low Veld of the Eastern Transvaal, the South-Eastern Highlands, the Southern Folded Region, and the Great Karroo.

The Coastal Belt fringes the sea and includes the land up to about 1,000 feet above sea level. It is only from the point of view of relief that this can be regarded as a unit, for it exhibits all varieties of climate and vegetation. In the west the plain is seldom more than 50 miles wide, and in some places along the south coast it becomes very narrow. Towards the north of Natal it widens out, and in Portuguese East Africa it attains a width of over 200 miles.

The indentations along the south coast are shallow bays open to the south-east, where the sea has scooped out the less resistant rocks, leaving the spurs of the coastal heights standing as prominent cliffs, as in Capes Blaize, St. Francis, and Recife.

The Low Veld of the Eastern Transvaal lies between the Drakensberge and the Lebombo range. On the west it is overlooked by the steep edge of the great escarpment. The Low Veld is traversed by the Olifants and its tributaries, and by streams flowing into Delagoa Bay.

The South-Eastern Highlands. This region comprises the broken country stretching from the Drakensberge escarpment to the Coastal Plain. In the west its limit is the Great Karroo and the eastern end of the Folded Region, and in the north it stretches to the southern borders of the Transvaal Low Veld. It thus includes most of the Eastern Province of the Cape, the Transkeian Native Territories, Natal, and Swaziland. (See map on page 56.)

The region is one of diversified relief. Much of the country has a terraced formation, although this characteristic is not so marked as in the western half of the Cape Province. The lofty Winterberge and the Amatola Mountains, as well as the highlands surrounding Kokstad, appear to be detached fragments of the main plateau.

The numerous steeply-flowing streams have great erosive power. They usually occupy deeply-cut valleys, and where they

reach a terrace-edge they frequently rush over hard cliffs into magnificent gorges, as in the Howick Falls on the Umgeni River in Natal, and the Tsitsa Falls in the Transkei.

The Southern Folded Region. The mountain ranges of this area are of the 'folded' type. The region therefore consists principally of high, serrated ridges, separated by long valleys, running roughly parallel to the south coast. In the west, however, these ridges

Photo.] [*S.A.R. Publicity Department.*

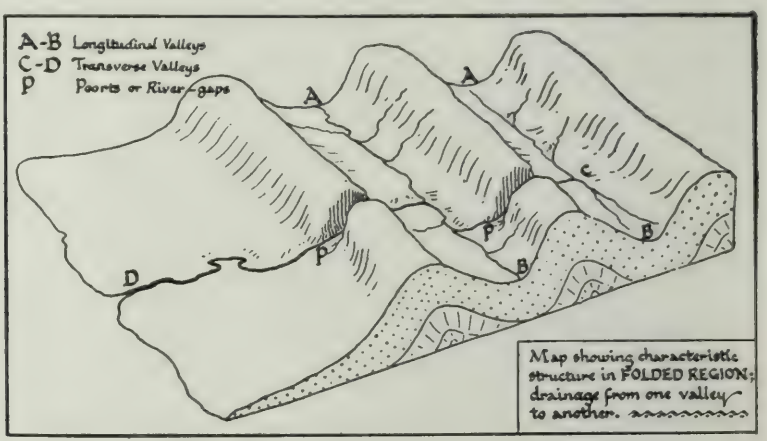
ENTRENCHED MEANDER, KOWIE RIVER.

and valleys have a north-to-south trend; where the two systems of folds meet, diagonal ranges run north-east, as in the Hex River Mountains. The Folded Region thus falls into two sections.

1. The first section extends from the Hex River Mountains eastwards to approximately longitude 26°. Two distinct series of ranges may be distinguished: the Coastal Ranges, including the Langeberge, the Outeniquas and the Zitzikamas, and the ranges further north, the chief of which are the Keeromberg, the Little and the Great Zwarteberge, the Baviaans Kloof and the Great Winterhoek Mountains. Towards the east the two series of ranges converge somewhat; but between the Zwarteberge on the north

side and the Langeberge and Outeniquas on the south is the Little Karroo, a low plateau having an average elevation of 1,500 feet.

Many rivers traverse this southern region, the chief being the Sundays River, the Gamtoos, the Gouritz, and the Breede. With the exception of the Breede these rivers rise in the escarpment of the interior plateau. In their upper courses they cross the Great Karroo and therefore contain little water except after the occasional rains. But where they enter the Southern Folded Region they are joined by longitudinal tributaries, and, since this is a region of heavier rainfall, these streams in their lower courses are more or less perennial and are utilized for irrigation. These



southern rivers are extremely interesting. At intervals they have cut through the mountain ranges gorges of surpassing splendour, and by these transverse ravines the drainage of one longitudinal valley escapes into the next. Meiring's Poort and Tover Water Poort in the Great Zwarteberge are striking examples of these deep and narrow defiles, their steep walls rising in precipitous cliffs hundreds of feet above the floor of the gorge. The whole region affords a good illustration of the control exercised over communications by relief, for the alternation of ridges and valleys makes the construction of transverse lines of communication very difficult.

2. The western section of the Folded Region extends from the coast northwards to the Van Rhyn's Dorp district. About midway the mountains are pierced by the remarkable Tulbagh Kloof. To the south of this kloof are the Vogel Vallei Mountains, the Drakenstein Range and the Hottentots Hollands Mountains. West of the Hottentots Hollands is a sunken area, the Cape Flats, bounded on the west by Table Mountain and lesser heights to the south.

Running eastwards from the Drakenstein Range are the Zonder Einde, which separate the deep valley of the Upper Breede River from its tributary, the Zonder Einde. In this region, girdled by beautiful mountain scenery, are many warm, sheltered valleys.

North of the Tulbagh Kloof are two well-defined parallel ridges with the Olifants River running between them. These are the Olifants Mountains on the west and the Cedarberge on the east. Towards the Doorn River, further east, the folds die out, and the country assumes a typical Karroo aspect.

The Great Karroo is an undulating area extending northwards from the foothills of the Folded Region to the escarpment of the interior plateau. It has an average elevation of from 2,000 to 3,000 feet. The ranges bordering it on the south and west act as a barrier to the moisture-bearing winds from the ocean, and the whole region is very dry.

Towards the south there are long stony ridges running east and west, but for the most part the rock-strewn surface is relieved only by scattered koppies.

Scenery.

As a result of diversity of structure, climate and soils, South Africa possesses a great variety of scenery, some of which is of exceptional beauty.

The Karroo landscape appears to be monotonous, but it is the type 'that grows on one.' Though flat and featureless, except for koppies which are rarely imposing, the vastness of the great plains, the brilliant colouring of the pinkish soil, the grey dustiness of the vegetation, and the hard blueness of the sky, have a peculiar charm. After rains, the flowers are unbelievably wonderful; so also are the sunsets and the rapidly-changing evening hues. Where there is irrigation the vegetation is vivid, the emerald oases standing out in superb contrast.

The massive escarpment, especially in Natal, is magnificently imposing. The sheer walls of volcanic rock are brilliantly coloured; foaming streams fill the steeply-cut gorges.

Across the escarpment the treeless grass steppe of the Orange Free State and the Southern Transvaal cover vast areas, and when the new grass appears there is the beauty of prairies in spring. The air is clear and 'wine-like,' visibility being so good that South Africa is one of the best regions in the world for astronomical observation.

Natal has a considerable variety of scenery, ranging from the 'heaped-up and jagged' Drakensberge to the sandy wastes of Zululand. The country is undulating, lacking the typical South African features. Semi-tropical vegetation and gleaming surf lend beauty to the coast.

Bechuanaland and the Kalahari, apart from beautiful sunsets, have comparatively little scenic charm. Along the west coast immense rolling sand-dunes, completely devoid of vegetation, constitute the only scenery.

In the South-West Cape there are lofty folded mountains separated by deep longitudinal valleys and crossed by wild transverse gorges. This region, which includes the Cape Peninsula, together with the lovely wooded country along the South Coast, has some of the finest scenery in the world.

The towns are often beautifully situated, and the old Dutch architecture is admirably suited to the environment. The streets of most of the towns are straight, wide, and often shaded by trees. Municipal gardens, natural parks, and afforestation add to and preserve the loveliness of the country. But magnificent town-sites are sometimes ruined by corrugated iron, slums, and styles of architecture that do not harmonize with the surroundings.

CHAPTER II.

CLIMATE.

In approaching a study of South Africa's climate let us notice certain well-known facts as our starting-point. We speak of "Sunny South Africa," a land of soft and genial weather, yet visitors to South Africa have often expressed surprise at the sudden temperature changes, the hard frosts, and the biting winds of the High Veld. Parts of South Africa, again, are almost rainless, whilst elsewhere the grass is always green, and the rainfall reminds one of the humid conditions on the Atlantic sea-board of Europe.

Further, Cape Town has winter rains and a dry summer, but over most of South Africa the veld during the winter months is brown and parched. Salisbury is well within the tropics, yet its average annual temperature is very little higher than that of Port Elizabeth. Invalids derive great benefit from the dry bracing air of the Karroo, yet the coastal districts of Northern Natal are humid, enervating and malarial. The western coast of South Africa is an arid waste of desert sand, while the eastern coast is a productive garden rich with sugar plantations and sub-tropical fruits. These familiar facts, with the arresting contrasts they disclose, forcibly remind one that South Africa affords numerous examples of interesting climatic variations.

Temperature. The northern portion of South Africa lies within the Tropics, and the remainder in the warm temperate zone. For purposes of comparison it may be pointed out that Pretoria is almost the same distance from the Equator as Benares, and that Bloemfontein and Delhi are in approximately the same latitude. But while the heat is almost unbearable for Europeans during the hot season at Benares and Delhi, the summer heat of Pretoria and Bloemfontein is rarely excessive. Two causes explain these striking contrasts. First, South Africa tapers bluntly towards the south, and on three sides faces large bodies of water; thus the relatively small and narrow land area allows the winds from the vast surrounding oceans to exert a moderating influence, so that mean annual temperatures are lower for South Africa than for places in similar latitudes in the Northern Hemisphere, where the proportion of land to water is much greater. But the difference is principally due to another and more potent cause, the influence of altitude on temperature.

In the chapter on structure and relief we have seen that South Africa consists of a series of elevated plateaux surrounded by a coastal belt. If we travel northwards, that is, towards the Equator, from the coastal lowlands of the south, we rise higher by steps or terraces, until we reach the highest plateau in the interior. The distinction between the low coastal plains and the interior plateau is very important, for the modification of temperature by height above sea-level has enabled people of the white race to settle and flourish in parts of South Africa where latitude, untempered by altitude, would not have allowed them to live in comfort.

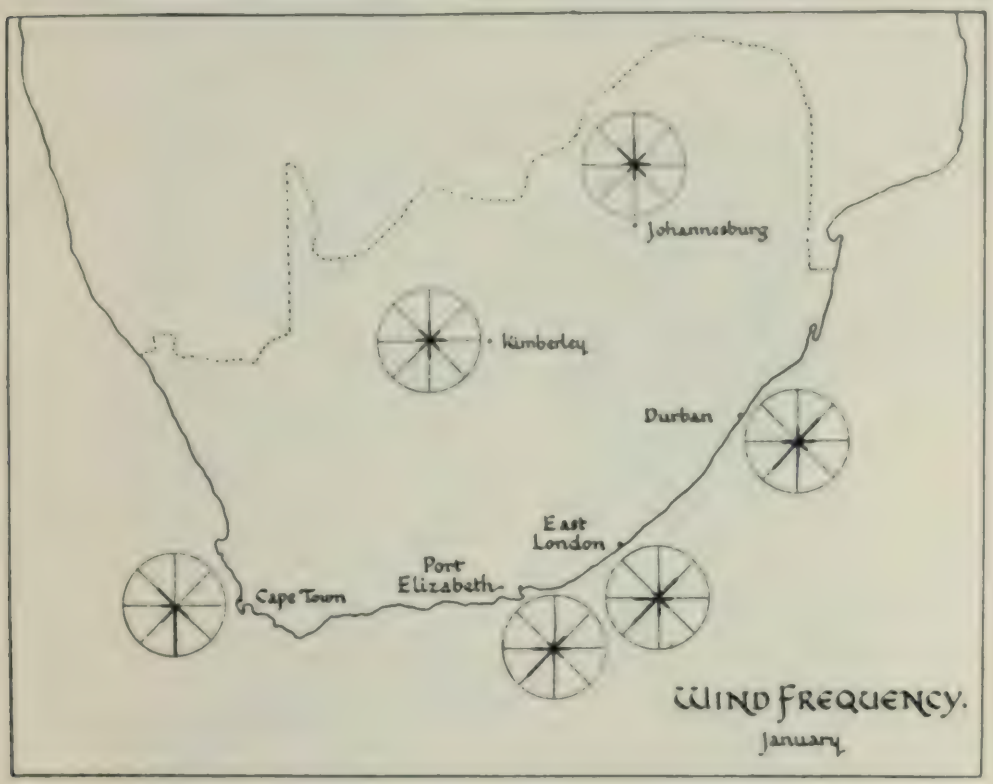
One example may be given as typical of the contrast between the warm lowlands and the cooler inland plateau. Pretoria, at a height of over 4,000 feet above sea level, has a mean annual temperature of 63° F., while Komatipoort, in approximately the same latitude, but at an elevation of only 620 feet, has a mean yearly temperature of 73·1° F., and is the warmest place in the Union.

Allusion has already been made to the healthiness of the climate of South Africa as a whole ; this is particularly true of the elevated interior, where the temperature differences from day to night and from summer to winter are so much more marked than at the coast. A moderate temperature range is essential for physical fitness and human energy, and from this point of view there are few parts of the world where the climate is more pleasant or more stimulating, particularly during the winter, than on the Karroo or the High Veld of the Orange Free State and the Transvaal. Here the land heats up rapidly during the day, especially under the cloudless sun of the dry months, and radiates its heat equally rapidly through the clear night air.

The effect of a considerable temperature range on the cultivation of crops will be at once apparent, and the Meteorological Department of the Union is now devoting great attention to the question of the distribution and duration of frosts over South Africa. These are of course very infrequent along the coast ; but in the interior frosts capable of freezing standing water are of almost daily occurrence during the winter months, so that in some parts of the plateau only frost-resisting varieties of cereals can be successfully cultivated. The whole question of climate in relation to vegetation will be treated in detail in the chapters on farming ; it is mentioned here as a reminder that in a country like South Africa, where the vagaries of temperature and rainfall are specially pronounced, the study of climate is essentially a practical matter.

So far we have emphasized the important distinction between lowlands and highlands. Another arresting contrast is that between the east and west coasts, the difference in mean annual temperature being primarily due to the influence of ocean currents. The cold Benguella Current flows northwards along the west

coast, and the winds blowing over the cold water lower the temperature of the adjacent land ; while the warm Mozambique and Agulhas Currents, flowing southwards along the east and south coasts, raise the temperature. The mingling of the cold and warm air where these currents meet causes persistent fogs off Cape Agulhas. Thus ships approaching Cape Town frequently find themselves surrounded by fog, and are obliged to remain stationary



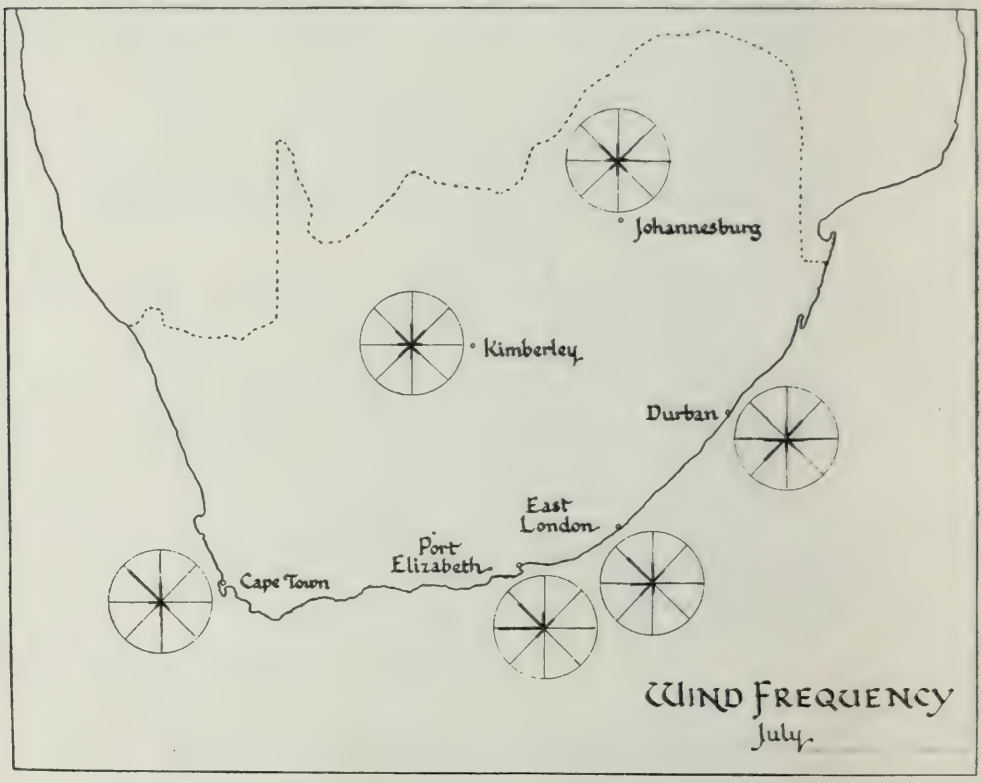
a few miles from the coast, whilst the city and Table Mountain are bathed in sunshine. Similar fogs occur, particularly in autumn, along the west coast. They are caused by the mingling of the cold air over the Benguella Current with the warmer land breezes.

The following table shows the contrast between the temperatures of the west and east coasts.

	Latitude	*Jan. Temp.*	*July Temp.*	*Annual Temp.*
Port Nolloth	29° 16′	59° F.	53° F.	57° F.
Durban	29° 52′	76° F.	64° F.	70° F.

Winds and Rainfall. In an earlier section of this chapter we have mentioned the fact that Cape Town receives winter rains, while over the greater part of South Africa summer is the rainy season. To understand this difference in seasonal rainfall reference must be made to the maps showing rainfall and pressure.

During the southern summer the sun is south of the Equator, being overhead at midday on December 21st at all places on the Tropic of Capricorn. The whole of South Africa is now in the track of the south-east trade winds, for the wind belts have moved south with the sun, and the north-westerly anti-trades are blowing south of the African continent. During this season, barometric pressures are lower over the land mass of South Africa than over the adjacent sea, and the winds are drawn strongly

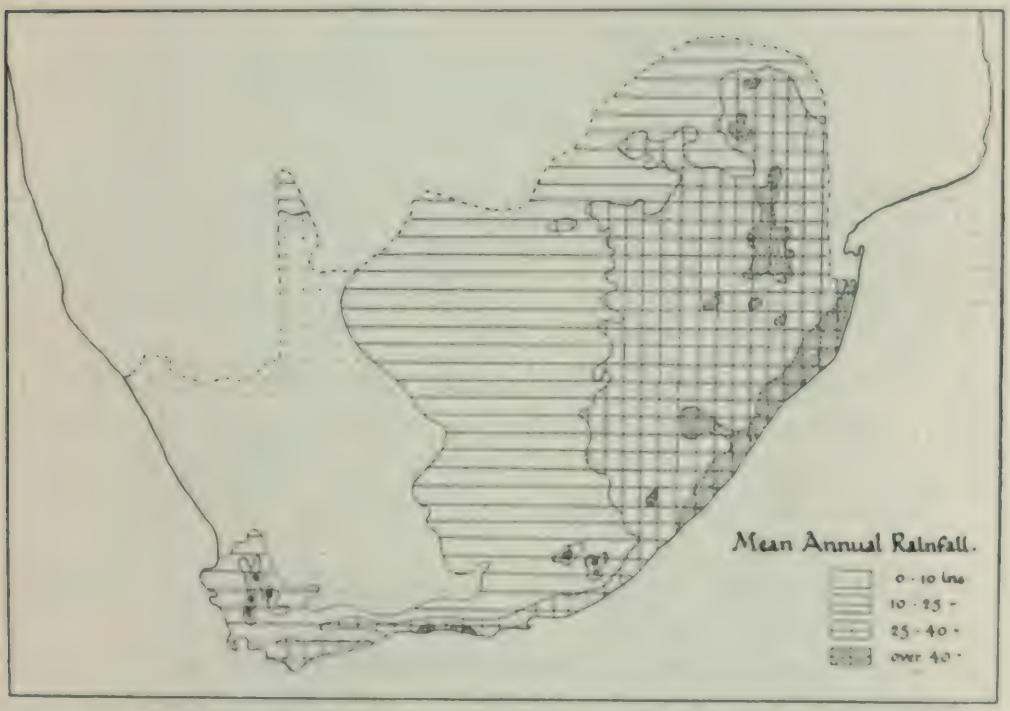


in towards the low pressures of the interior. The High Drakensberg scarp is near the east coast, and the moisture-laden winds strike this mountain barrier at such an angle that they are forced to ascend. In rising they become cooled, and copious rains fall on the coastal plain ; but the Drakensberge, unlike the Himalayas and the Andes, do not form a complete barrier to the moisture-bearing winds. Thus moisture is carried beyond the eastern rim of the plateau, and, under the influence of convection currents, heavy summer rains fall over the eastern part of the tableland. These rains will naturally be heaviest in the east, and gradually diminish towards the west.

Why does not the region round Cape Town receive rain from the south-east trades in summer ? Here the mountain ranges trend north to south, so that the winds are blowing in a direction

almost parallel to the ridges, and there is no intervening barrier to cause them to give up their moisture. Further, the trade winds are great arterial currents, moving from cooler to warmer latitudes, and thus their capacity for holding moisture is becoming greater.

From December 21st the sun begins his northward march, and the wind belts follow. By the time the sun's direct rays are falling north of the Equator it is winter in South Africa, and in mid-winter the trade wind belt extends south only to about latitude 24° S. Pressures are now highest over the Orange River basin; to the



south of this area the prevailing winds are north-westerly and westerly. The Cape Town region and the south coast are now in the track of the cyclonic depressions associated with the westerly anti-trades. Naturally the rain is now heaviest in the south-west, where the direction of the mountain ranges causes the winds to ascend and shed their moisture mainly on the seaward side.

From the map showing pressures it will be seen that a vast anti-cyclone lies over the plateau, so that the winds flow outwards from the interior towards the coast.

Annual Rainfall. If a map showing the average yearly rainfall is examined, it will be seen that there is a general decrease in amount as we leave the east coast and proceed westwards, though there are areas of heavy rainfall along the south coast. The narrow coastal strip stretching south-west from Durban receives over 40 inches of rain per annum; then precipitation decreases until

the highest parts of the Drakensberg scarp are reached, and here the yearly rainfall is over 45 inches. Beyond the crest of the Drakensberge the amount decreases steadily, until we reach the Namib, a strip of true desert along the west coast.

The following table illustrates the general decrease in rainfall from the east coast westwards, all the towns being in approximately the same latitude.

	Annual Rainfall.
Durban	40·5 inches
Ladybrand	30·6 ,,
Bloemfontein	22·0 ,,
Kimberley	17·5 ,,
Prieska	9·5 ,,
Port Nolloth	2·2 ,,

It is specially important to notice the 20-inch rainfall line. This follows an irregular course that might be drawn from Mafeking through Bloemfontein to Port Elizabeth. To the west of this line, except in the south-west corner and along the south coast, are the dry lands of South Africa.

South Africa may be divided into the following climatic regions:

1. The south-west corner (the Mediterranean region), receiving almost all its rain in the winter months.
2. The south coast region with rain in both summer and winter.
3. Most of the plateau with almost all its rain falling in the summer months.
4. The remainder of South Africa, with very scanty rains.

From the point of view of the farmer the nature of the rainfall is of very great importance. If the annual rainfall map alone is consulted, there would at first sight appear to be little reason to regard South Africa east of the Kalahari region as unfavourably placed with respect to the total quantity of rain received. Unfortunately, however, over most of the summer rainfall area the rains are not reliable. Heavy rains fall in torrential thunderstorms when the heat is greatest, and when the ground is often baked hard. There is thus a great loss through rapid run-off, and, on account of the heat, evaporation is considerable. The spasmodic and intermittent showers, usually followed by periods of drought, have therefore much less value for agricultural and pastoral purposes than the lighter and more regular showers which soak into the ground and are not swept away to the sea.

The problem of water conservation is thus of supreme importance in South Africa.

CHAPTER III.

NATURAL VEGETATION AND ANIMAL LIFE.

The distribution of vegetation is determined mainly by the nature of the climate, and, to a lesser extent, by the character of the soil. The chief climatic factors are rainfall and temperature. Where rain falls throughout the year, as in the Knysna district, the natural vegetative response is forest. In parts of Natal and other south-eastern districts the rainfall is largely confined to the summer months, but the rain is sufficiently heavy and persistent to penetrate the subsoil and keep it partially moist throughout the year ; hence forests occur also in such regions of heavy summer rainfall. In the south-west region of the Cape the rain falls mainly in the cooler season, when evaporation is slight ; but this rainfall, except upon the mountains, is not heavy, and the trees that best survive the long hot summer months are those possessing certain xerophytic characters. Protective devices are evident, for instance, in the heaths and proteas of this region. A moderate summer rainfall may produce that type of woodland known in South Africa as Bushveld. The effectiveness of light summer rains, or summer rains of short duration, is reduced by evaporation, so that moisture seldom penetrates to the subsoil. Such conditions, however, encourage the growth of grasses, which spring from the ground with great rapidity, and tend to stifle any beginning of tree growth. The scarcity of woodland over a large part of South Africa is due to this cause.

The Main Types of Vegetation.

Natural vegetation is usually divided into three main types, called ' formations ' by plant geographers. These are Woodland, Grassland and Desert and Semi-Desert.

1. Woodland. In South Africa this includes Forest, Scrub and Bush.

Forest. (a) True forests exist in a comparatively small region along the south coast, forming an almost continuous belt, roughly a hundred miles long by ten miles broad, on the seaward flanks of the Outeniqua, Lange Kloof, and Zitzikama Mountains. Here

the annual rainfall is about 35 inches, and is fairly evenly distributed throughout the year. Under the tall timber trees of this region ferns grow in profusion and climbers like the monkey-rope are common.

Photo.] [*S.A.R. Publicity Department.*

KNYSNA FOREST.

(b) Sub-tropical forests occur in isolated patches along the narrow strip of coastal country extending northwards from the neighbourhood of Port Elizabeth. The chief of these are (i) those near East London and King William's Town, (ii) the Mamubi Forest, situated a little further north along the coast, (iii) the Egossa Forest, north of Port St. John, occupying a strip about 20 miles long and 2 miles in width.

(c) Forests of a more temperate type occur on the eastern and south-eastern slopes of the Stormberge and Drakensberge ranges.

Scrub. In the south-western region of the Cape Province grass is never a conspicuous feature of the country ; the predominant vegetation has the form of shrubs and bushes. The plants are adapted to withstand the summer drought ; often their roots are of great length, whilst from their small or leathery leaves little transpiration can take place. The typical bush is the protea, of which there are many varieties. Beautiful heaths and bulbous plants are common. The graceful silver-leaf tree is peculiar to this winter-rainfall area.

It is probable that at one time the woodland character of the south-west region was far more pronounced than it is to-day. Near Swellendam, in the deep kloofs and gullies of the Langeberge, the remnants of a forest still exist ; and the Clanwilliam cedars in the Cedarberge are also the remains of a forest which apparently was at one time much more extensive.

It should be noted that only a small part of the South-Coast Region consists of true forest. The predominant vegetation of this area bears a close resemblance to the scrub vegetation just described.

Bush. Bush forms a large portion of the natural vegetation of South Africa, the appearance of bush country varying greatly in different parts according to differences in climate and soil.

Along the coast where the rainfall is high and frost is absent, the bush is dense and sub-tropical in character ; further inland a decreasing rainfall causes the bush to be more open, while in the interior it becomes still more open and park-like.

(i) The East Coast Bush comprises a narrow coastal strip of low-lying land, extending from near East London northwards through the Transkei, Natal, and Portuguese East Africa. It has a fairly high temperature and a summer rainfall of about 40 inches. In this belt the most characteristic plants are the palms. The coastal bush is very dense, the trees having an average height of 20 to 30 feet, and climbing plants like the wild grape occur in great abundance. In the northern portion of this belt, where lagoons occur along the coast, mangroves are characteristic of the mud swamps.

(ii) In the north-east of South Africa, bushveld occupies the extensive basin of the Limpopo and its tributaries, and thus includes a large part of Portuguese East Africa, the low-lying portion of Southern Rhodesia, and the Northern and Eastern Transvaal.

Within this region the rainfall varies considerably, so that the trees include varieties ranging from the baobab to the acacia. The country generally is covered with trees varying in height from 30 to 50 feet but sufficiently far apart to allow a dense growth of grass and shrubs. Along the river valleys the vegetation is very luxuriant.

(2) GRASSLAND. In the chapter on climate we saw that generally speaking the rainfall of South Africa diminishes from east to west, and that the sub-continent as a whole suffers from uncertain or insufficient rainfall. Hence large areas of the country are grass-covered. But grassland vegetation in South Africa is considerably diversified because of differences in temperature, rainfall and altitude, and the nature of the soil. Speaking generally, grass is the dominant vegetative covering of the summer rainfall area, i.e., nearly all the eastern portion of the country. The grasslands may be sub-divided into :

(a) *The High Grass Veld* covering the greater portion of Basutoland, the Orange Free State, and the Southern Transvaal.

This rolling grass country lies at an average height of 4,000 to 5,000 feet, receives summer rains, and has dry winters with severe frosts. The rainfall varies from 20 to 30 inches annually, and since the rain comes at the hot period of the year, when evaporation is rapid and plants transpire profusely, the region is practically without trees or bush except along the sides of streams and in the mountain kloofs of Basutoland. In summer the vegetation is bright green, becoming reddish-brown in winter, when many farmers drive their stock to the lower Bushveld. The High Veld affords excellent grazing for cattle and sheep.

(b) *The Kalahari Region.* Towards the west of this High Veld region the rainfall becomes scantier and the vegetation consequently less luxuriant ; the grass now forms tufts, instead of turf. But the Kalahari, though popularly known as desert, has a summer rainfall of over 10 inches. Indeed, the Kalahari in many parts supports a growth of well-developed trees, so that some authorities class it as woodland. From the point of view of the geographer, however, it is best described as a transition area, a step between the true desert and the grass or bush land.

(c) *The Eastern Grass Veld.* This grassland area embraces the undulating country stretching from the neighbourhood of Port Elizabeth to the north of Natal, and from the Drakensberge to the sub-tropical palm belt that fringes the east coast. The average annual rainfall is between 25 and 40 inches, falling mainly in the summer months.

The general aspect of the country is that of grassland with scattered thorn-bush like the mimosa, and succulents like the aloe. Towards the south-west there is a gradual transition to Karroo vegetation, while with increased rainfall and higher temperature thick bush becomes conspicuous in the valleys towards the north-east.

Naturally the vegetation varies with altitude, so that this Eastern Grass Veld is sometimes sub-divided into Thorn Veld and Berg Veld. The Thorn Veld occupies most of the country

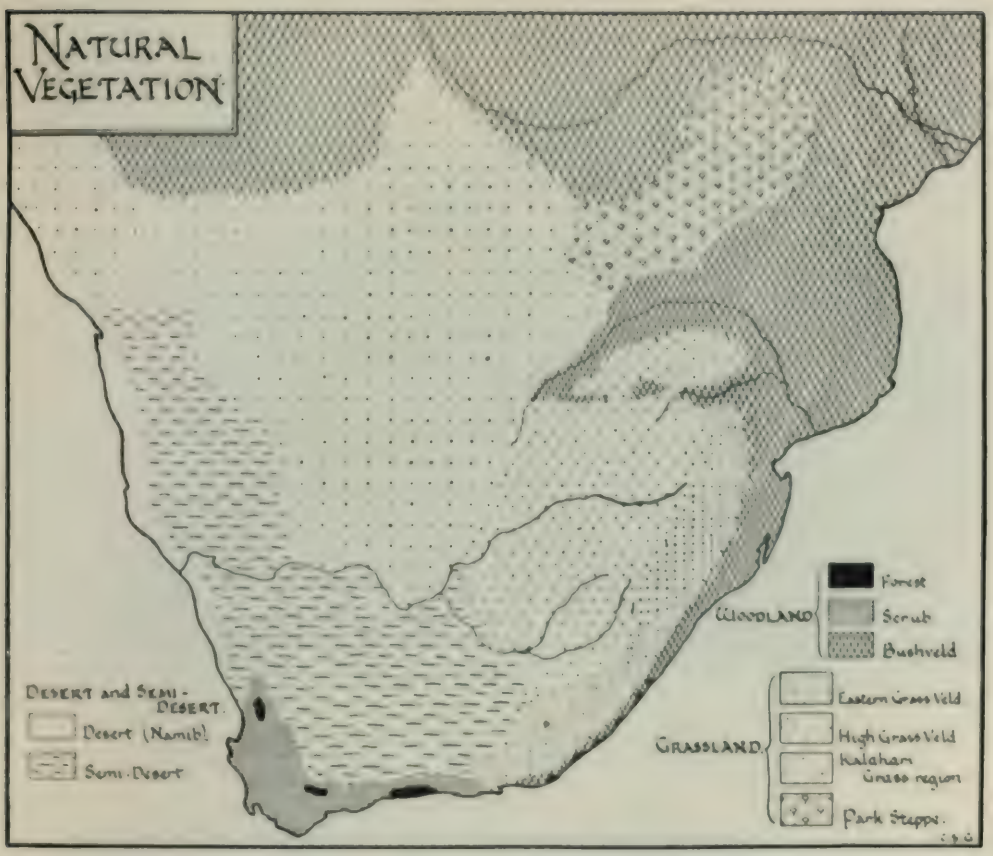


Photo.] [*Dr. R. S. Adamson.*

GRASSLAND, N. RHODESIA.

Photo.] [*S.A.R. Publicity Department.*

SAVANNA FOREST, S. RHODESIA.

Photo.] [*Dr. R. S. Adamson.*

THORN SAVANNA, S. RHODESIA.

Photo.] [*Dr. R. S. Adamson.*

GRASSLAND WITH ACACIAS, QUEENSTOWN.

Photo.] [*Dr. R. S. Adamson.*

LITTLE KARROO.

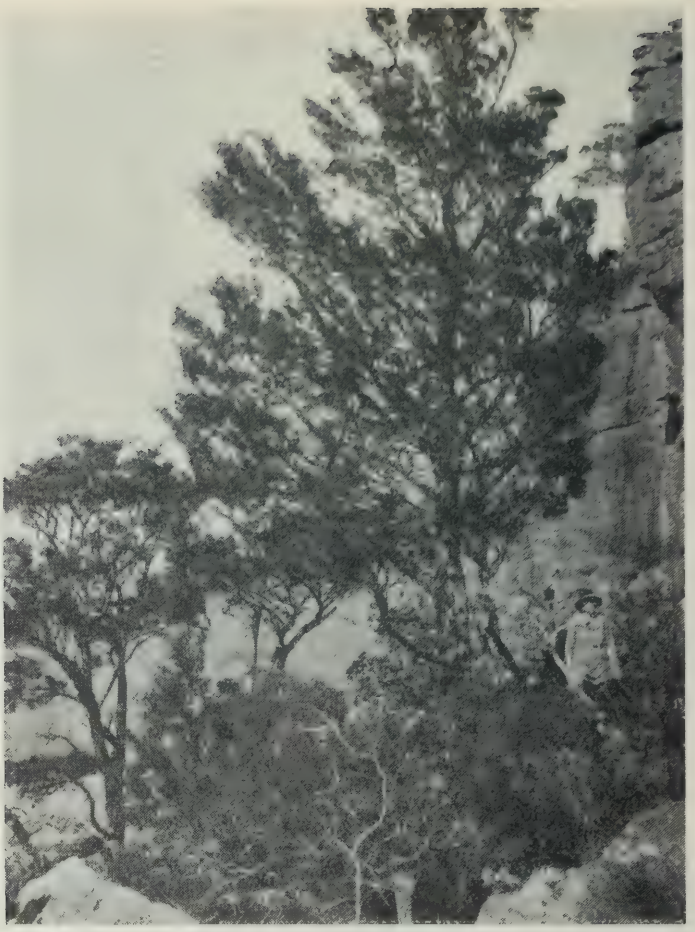


Photo.] [*Dr. R. S. Adamson.*

CAPE CEDAR, CEDARBERGE, C.P.

Photo.] [*Dr. A. W. Rogers.*

BED OF MOLOPO RIVER.

between the narrow coastal strip and the foothills of the escarpment to an altitude of 4,000 feet. This Thorn Veld is frequently referred to as 'Sweet Veld' and is excellent pasture country. The Berg Veld, known to farmers as 'Sour Veld,' extends up the eastern slopes of the escarpment from a height of about 4,000 feet.

(3) Desert and Semi-Desert. (a) The only true desert regions in South Africa are the Namib, the coast region extending from Lambert's Bay, near Clanwilliam, northwards to Cape Frio, and the lands bordering the Orange from Upington to the sea. There is scarcely any vegetation; the few plants that do occur are highly specialized for life under such dry conditions.

(b) South-West Africa and Little Namaqualand are semi-desert regions. Except to the north of Windhoek, the sparse and scanty vegetation consists of thorny shrubs and shrublets, succulents, and tuberous and bulbous plants.

(c) The Little Karroo, the Great Karroo, and the Northern Karroo have a rainfall that is so scanty and spasmodic that the vegetation must be described as semi-desert. The region is practically devoid of trees except along the river courses, where at intervals thorn-trees occur, and the vegetation is composed largely of succulents such as the aloe, euphorbia and mesembrianthemum, and small shrubs which have adapted themselves to the dry conditions. The Karroo Bush, however, affords good pasture for sheep and goats. After the rains the many varieties of bulbous plants come out in bright flowers and the appearance of the country is marvellously transformed.

In the eastern part of the Karroo the prickly pear, which spreads with great rapidity, has tended to obliterate other kinds of vegetation. Attempts are being made to get rid of this pest by the introduction of insect-parasites.

Animal Life.

From the accounts of the early settlers and the records of explorers, we know that in the seventeenth century most of the big animals of Central Africa were common as far south as the Cape. Van Riebeeck's journal contains many references to the larger animals which then abounded in the neighbourhood of the fort at Cape Town, and from his diary we learn that in 1652 hippopotami wallowed in the swamps now occupied by Church Square, Cape Town. Over the wooded slopes of Table Mountain herds of eland, hartebeest and koodoo roamed, and lions were not uncommon near Cape Town as late as 1707. It is said that Simon van der Stel's coach was on one occasion upset by a rhinoceros.

The many places in the country which to-day bear the names of animals remind us of the great wealth of animal life existing

in South Africa in former times. Zeekoe (hippopotamus) River, Buffalo River, Olifants River, Rhenoster (rhinoceros) River, Hartebeest River, Tygerberg and Elandsfontein are a few such names.

Formerly natives were the only enemies of these large animals, but with the advent of the European they were hunted with deadlier weapons. Gradually, with the spread of settlement and the increase of population, the large animals have retreated to the more inaccessible parts, and, except in the game reserves, are rarely seen south of the Limpopo River.

The largest game reserve in the country is the Kruger National Park, occupying an area of about 8,000 square miles in the Eastern Transvaal ; the reserve comprises the former Sabie and Shingwedzi Reserves. In this, as in other game reserves, no hunting is allowed.

Hooped Animals. Since a large part of South Africa consists of open, treeless country, antelopes were once very common. Thirty-four species of antelope have been found in SouthAfrica, ranging from the noble eland to the tiny blue duiker. The eland, the largest of South African antelopes, was once distributed all over the country, but is now found only in the Kalahari and among the mountains of Basutoland. The chief of the other species of antelope still found are the spiral-horned koodoo of the bush country, the gemsbuck, steinbuck, klipspringer and springbuck.

The giraffe is still found in the Kalahari, and the zebra still roams the mountains in various parts of the country, but the quagga, an animal allied to the zebra, is now believed to be extinct.

Until about the year 1830, elephant hunting was regularly pursued in the eastern part of the Cape Province, but to-day elephants are practically extinct south of the Limpopo River. Until a few years ago they were numerous in the Addo Bush near Port Elizabeth, but only about 50 remain to-day.

The rhinoceros and hippopotamus are now rarely seen further south than Zululand.

Carnivorous Animals. The lion, formerly distributed over the whole of South Africa, is now found only in the more northerly regions.

The leopard, wrongly called the tiger in South Africa, is still fairly common among the rocky hills of parts of the country.

The cheetah is found in Bechuanaland and the Northern Transvaal. Various species of wild cat are common, and are a source of annoyance to poultry farmers. Jackals and wild dogs are among the chief pests of South Africa owing to their ravages among small stock. They are very cunning and difficult to trap.

PRIMATES. Owing to the scarcity of forests in South Africa the monkey family is not well represented. Baboons, however, are very common among the kranses and rocky hills so prominent in South African scenery ; here they live in troops, coming down from their rocky homes to rob orchards and gardens.

BIRDS. South Africa is extraordinarily rich in bird life. Here we can mention only a few species.

The secretary bird is sometimes seen on the veld. It feeds on snakes, lizards, small tortoises, rats and frogs, killing its prey by the stamp of its foot.

Locust birds are very useful to farmers, for they follow swarms of locusts and feed on the young.

There are seven species of vulture indigenous to South Africa. They are among the chief scavengers of the veld, feeding on rodents and insects, and any carrion except the remains of their own species.

The ostrich formerly roamed the veld in a wild state, but is now domesticated and largely confined to farms. A few troops of wild ostriches are still to be found in the Northern Kalahari and in South-West Africa.

Sugar birds are peculiar to South Africa. There are two species, the Cape long-tailed sugar bird, which builds its nest in the protea bush, and the rarer species found in Natal. They are very useful to farmers as they destroy harmful insects.

South Africa has also many migratory birds, such as the stork, swallow and cuckoo, which come here from Europe during the northern winter.

There is a rich variety of birds round the coasts of South Africa, cormorants and duikers being very plentiful. At Dassen Island and other islands off the south-west coast penguins in great numbers may be seen.

Few South African birds are remarkable for sweetness of song, but many have brilliant plumage.

REPTILES. Crocodiles are still found in the Limpopo River. Lizards are very common, the largest being the iguana, which is a nuisance to poultry-keepers. Snakes of many different species abound ; many are poisonous. The mamba is a very deadly snake, common in low-lying bush country ; it sometimes reaches a length of ten feet. The python, which crushes its prey in its folds, may be as long as twenty feet, and is found in parts of Natal and the Bush Veld of the Transvaal.

Among the smaller species are the yellow cobra, the ringhals, the boomslang and the puff-adder.

Insects. Locusts are the most injurious insects in South Africa. They breed in the arid regions of the interior. In this country the young locusts are called 'voetgangers,' and, both in this stage and after developing wings, they devour every green thing in their path.

Mosquitoes are common throughout the country. In the low-lying parts of Natal, Zululand, the Transvaal and Rhodesia malarial fever is transmitted by infected mosquitoes.

Another very dangerous insect is the tsetse fly. Its particular home is East Africa, and it invades South Africa from the north.

CHAPTER IV.

FORESTS AND AFFORESTATION.

The climatic conditions necessary to forest growth have been described in relation to vegetation generally, and should be referred to again as an introduction to the present chapter. In addition, certain economic principles, as distinct from climatic factors, must be noticed.

(1) Timber production is for several reasons a most important and essential industry. It is also extremely profitable. Compared with agriculture, it is less affected by the variableness of climate, and is therefore a less speculative enterprise. Tree-planting, moreover, has advantages other than the profit to be derived from the utilization and sale of timber. Forests serve as wind-breaks, and to some extent protect the veld, as well as cultivated land, from the devastating effect of hot or violent winds. Trees planted on farms have a value in regard to landscape effect; they also afford shelter to stock in hot weather, and by binding the soil together help to prevent the formation of dongas, and the resulting loss of agricultural soil, during heavy rains.

(2) Since the bulkiness of timber makes it an expensive commodity to transport long distances, it is recognized that as far as possible it should be grown where it is likely to be required. Afforestation schemes in South Africa are therefore being pressed forward, particularly in the Transvaal, where industrial development is already considerable and will probably proceed still further.

(3) While trees may adapt themselves somewhat to adverse climatic conditions, forest industries carried on in such circumstances are not always economically successful. Trees cultivated away from their natural home are apt to be stunted or misshapen, or may require expensive treatment to keep them alive. The oak trees of Cape Town afford a good example.

(4) Trees will not be grown on land which has a higher value for other purposes. For this reason land is sometimes cleared of its original forests in order that cultivated crops may be produced.

Only a small portion of the woodland area of South Africa may be said to consist of true forest, the remaining part being covered

with vegetation in which bush or scrub predominates. As already stated in a previous chapter, dense forests occur as follows :

(a) In the South Coast region, between *George* and *Humansdorp*, the chief centre being *Knysna*.

(b) Along the coastal plain extending north-eastwards from Port Elizabeth.

(c) On the eastern and south-eastern slopes of the Stormberge, Drakensberge, and other mountains further north.

These forests produce yellowwoods, assegaiwood, ironwoods, Cape box, stinkwood, Cape ebony, sneezewood, kamassiwood and other varieties. They are for the most part hardwoods, and are used in the making of furniture, wagons and railway-sleepers, as well as for building purposes.

Tree-growth is of course by no means confined to these naturally well-timbered areas. Even on the scrublands and in the bushveld there are scattered trees, which often give the country a park-like aspect. The baobab tree of the Limpopo bush-veld, the kareeboom and numerous acacias of the dry upland areas, together with the silver-trees, cedars, and wild olive trees of the south-western region, are typical examples. Such trees have decorative value, and often serve various useful purposes locally ; otherwise they are of little economic importance.

The rapidly increasing shortage of timber, especially of soft coniferous wood, is one of the world's most pressing economic problems. In South Africa the position is serious. For every acre of forest in South Africa, New Zealand has 20 acres, Australia 250, and Canada 600. The rapid economic development of Canada in comparison with our own country is undoubtedly due, in large measure, to her immense wealth of timber. In South Africa so small is the production of timber that in some years our imports of this commodity have more than balanced our export of diamonds.

It may therefore be expected that the Union Forest Department should vigorously safeguard and augment our forest resources. Details of this policy are as follows :

(a) Indigenous forests are protected from the destruction which has wasted them in the past. Thorny vegetation detrimental to tree-growth is removed ; exploited and burnt areas are replanted. These measures have been so successful that in some years there is a small surplus of hardwoods available for export.

(b) Experiments are conducted with a view to the introduction of foreign trees, wherever soil and climatic conditions are favourable. Such afforestation schemes are especially necessary in respect of softwoods. Plantations of pines, gums, poplars and other trees now occupy nearly a million acres.

(c) The afforestation of land privately owned is encouraged in every possible way. Expert advice is readily given, whilst every year government nurseries dispose of millions of saplings.

(d) Research is being undertaken with the object of rendering timber less susceptible to fire and to the attacks of insects and

Photo.] [*S.A.R. Publicity Department.*

WATTLE TREES.

fungus. Sneezewood, Knysna ironwood and certain other South African woods are naturally durable; but, since the supply of these varieties is insufficient, it appears desirable to prolong the life of softer woods, especially when used for outdoor purposes or in contact with the ground, by some preservative treatment.

(e) Since an enormous waste of timber occurs through defective seasoning, the modern system of seasoning timber in kilns is now employed by the Forest Department.

The following list includes the more important plantation trees :

(1) *Eucalyptus.* The species most successfully cultivated are giant gum, blue gum, willow gum, saligna gum, karri, red gum, and red mahogany (*Eucalyptus resinifera*). Eucalyptus trees yield more timber, and in less time, than any other kind of tree grown in South Africa. Although examples are known of gum-trees, even in South Africa, with a girth of thirty feet and two hundred feet in height, it is more profitable to fell the trees before they attain such giant proportions. The timber is used for building and in the making of mine-props, railway sleepers, and fencing. Most varieties of eucalyptus are hard-woods. The saligna gum, however, which grows particularly well, is almost a soft wood, and yields timber for box-making

(2) *Pine.* Although timber obtained from pine-trees is the kind most used for building purposes and in box-making, we import nine-tenths of the amount used in the country. Of the varieties tried hitherto, *Pinus insignis* has been found most successful. Although a native of California, it thrives in South Africa in summer-rain as well as in winter-rain areas.

(3) *Wattle.* Plantations of black wattle (*Acacia mollissima*) occupy 525,000 acres, mainly in Natal. A summer rainfall of 30 to 40 inches is most suitable. The trees are felled when large enough to be used as mine-props ; the bark is then stripped off, and compressed hydraulically into compact blocks, which are exported chiefly to Britain, the United States, Germany, Australia, and Japan. Wattle-bark contains tannin, which is used in leather manufacture.

(4) *Poplar.* The timber of this tree is greatly in demand for the manufacture of matches. Poplars grow best in the neighbourhood of mountain streams.

(5) *Oak.* Simon van der Stel required each settler to plant 100 oaks on his land. Climatic conditions, however, are not ideal. The trees grow too rapidly, the grain becoming coarse and knotted, so that for the making of wine-casks coopers obtain their oak from Europe. Oak-furniture also is made from imported timber. The cork-oak, an evergreen indigenous to certain Mediterranean countries, is grown for its cork-bark. Its cultivation in South Africa is not yet commercially successful, an ideal locality not having been found.

CHAPTER V.

FISHING AND ALLIED INDUSTRIES.

Although the Dutch are traditionally a sea-faring people, the fishing industry of South Africa is identified mainly with the coloured population. Whilst Van Riebeeck's policy was to develop the pastoral and agricultural industries, it remained for liberated Malay slaves, and more recently immigrants from Sicily and elsewhere, to develop the fishing industry.

Primitive as were the methods of the Malay fishermen—snoek were caught by means of a hook to which a fragment of bright-coloured cloth was fastened—the output was sufficient to meet the need of the small communities within easy reach of the coast. But with the discovery of gold and diamonds large inland towns came into existence, and when railway development made these centres accessible from the sea, the demand for fish began to exceed the supply. Trawler-fishing carried out by vessels fitted with refrigerating apparatus began to supplement the inshore fishing hitherto practised.

A trawler remains at sea for an average period of 8 or 10 days, and returns to port with a cargo of 15 or 20 tons of fish. The vessels are provided with a tapering net, called a trawl, which is drawn slowly across the floor of the sea. The method is particularly suited to the capture of stockfish and soles, which prefer deep water; an hour's trawling may result in a catch of several thousand fish. One aspect of recent progress is the conversion of the open boats used by the Malays for inshore fishing into covered motor-driven vessels.

The most important fishing-grounds are those of the shallow seas which wash over the continental shelf; for it is in these waters that marine vegetation, upon which fish feed, grows most abundantly. To the west of the Cape Province this submarine platform has an average width of 30 miles; off the shores of Natal it is narrower; but south of Cape Agulhas it attains a width of 150 miles. The Agulhas bank is therefore a fishing-ground comparable in area with the Dogger and Newfoundland Banks; but up to the present only about one-eighth of the total area of 6,000 square miles has been explored and utilized.

The chief fishing stations are *Cape Town*, *Kalk Bay*, *Saldanha Bay*, *Mossel Bay*, *Port Elizabeth*, *East London*, and *Durban*. At some of these ports fishing harbours have been constructed.

Food-fishes caught in South African waters include stockfish, snoek, soles, crawfish, silverfish, stumpnose, kabeljauw, pangas, harders, kingklip, mackerel, and many others.

Stockfish (cod) is filleted and smoked. There is a surplus for export.

Snoek, caught mainly off the west coast of the Cape Province, is found only in the Southern Hemisphere.

Soles are even more plentiful than in the seas around Britain. Since they remain fresh and palatable when packed in ice, an export trade in this direction is likely to develop.

Crawfish are found in immense numbers from Cape Point northwards along the west coast, and to a less extent in Natal waters. At present no other part of the world possesses these crustaceans in such abundance. The annual catch numbers over 15 millions. There is a large export trade in tinned crawfish, largely to France.

In what directions may a further extension of the fishing industry be anticipated ?

(*a*) There are many country districts in which fish can scarcely be obtained. With improvements in storage and transport, *e.g.* by the provision of fish-trains, like those which supply the Johannesburg market, these inland centres would purchase more fish than at present.

(*b*) Dogfish, shark, skate and other inedible fishes make excellent stock-food and artificial manure. Fish-fertilizers are especially rich in phosphates, in which South African soils are frequently deficient. Moreover, there are possibilities of an export trade in these products.

(*c*) It may be practicable to introduce the herring into South African waters. There is precedent for such a policy in the United States, where certain food-fishes indigenous to the Atlantic side have been successfully transferred to the Pacific fishing-grounds.

(*d*) Curing and canning, already prosperous industries, are capable of further development. Our imports of dried and preserved fish amount to about £400,000 annually ; with the proper utilization of her own resources, South Africa could become very largely independent of these foreign supplies.

Whaling, Sealing, and other Industries. In Van Riebeeck's *Journal* and other early records there are entertaining passages relating to the capture of whales and seals in Table Bay (*cf.* Robben Island, *robbe*, a seal). Whale and seal oil were useful as illuminants, and were exported both to Holland and to Batavia. The first export from the Cape to Europe was a parcel of 2,700 sealskins. The chief centres were Walvis and Saldanha Bay. The export trade has recently declined, sealskins being luxury articles.

Although subject to certain restrictions, the hunting of whales is carried on by private companies. Since about 3000 are usually caught in the course of a year, the average value of one whale being several hundred pounds, the industry is one of considerable importance. Whale-oil, obtained mostly from the blubber, is called train-oil. Whale-bone and ambergris are also valuable. Those parts of the animal which can be put to no other useful purpose are reduced to fertilizers. Durban and Saldanha Bay are the chief whaling stations. Norwegian and British whaling companies also use these ports.

The abundance of fish in the shallow waters off the west coast is attested by the vast numbers of penguins, duikers and other sea-birds which use the numerous islands of this region as their resting-place and breeding-ground. On the Ichaboe Islands alone, near Luderitzbucht, flocks amounting to a total of twenty million birds have been estimated at one time. Penguin eggs are collected on Dassen Island ; the industry is in the hands of Government contractors.

Another product is guano, derived from the excretion of sea-birds. About 10,000 tons are collected annually. The substance is preserved only in a dry climate, like that of the barren islands and rocks which fringe the west coast. Its high potash and phosphoric-acid content makes guano a valuable fertilizer, especially for the cultivation of cereals. It is sold by the Government for use within the Union of South Africa, at a price considerably lower than the world market-price. Western Province farmers purchase the greater part of the amount collected. The sea-birds, however, consume such vast quantities of fish that it may be doubted whether their preservation is economically sound.

CHAPTER VI.

SOIL, SOIL-EROSION AND IRRIGATION.

Soil and Fertility. Soil is mainly the result of the decomposition of rock, brought about through atmospheric and climatic agencies and through the action of water. In addition soil usually contains humus, a valuable constituent produced by the decay of vegetation. In any locality the rock-derived part of the soil may be a decomposition product of the underlying rocks, or it may have been transported by wind or water from elsewhere.

The fertility of soil depends upon several factors.

(a) Transported soil consists of finer particles, and therefore more readily yields plant-forming elements, than the larger rock-fragments of local origin. This explains the astonishing fertility of river-plains, like that of the Ganges. One reason for the comparative infertility of South Africa as a whole is the absence of extensive alluvial (i.e. waterborne) deposits. South Africa possesses no extensive deep-soiled plains, like those, for example, of the Argentine. However, alluvium carried down by the rivers of the Great Karroo has enriched the valleys of the Gamtoos, Breda, Great Fish, and Sundays Rivers, as well as considerable areas of the Little Karroo. It is in these valleys that irrigation has proved most successful.

(b) Fertility depends also upon the kind of rock from which the soil has been derived ; igneous rocks like dolerite and granite yield more fertile soils than those derived from sandstone and other aqueous rocks.

(c) The climatic conditions under which soil has been formed help to determine fertility. The soils of arid regions like the Karroo are often exceptionally fertile, and require only irrigation to produce heavy crops ; for they have retained all the plant-forming elements which in wetter districts tend to be washed out.

(d) The fertility of soil is increased by the presence of micro-organisms, which help in the conversion of soil-elements into plant-elements ; hence the utility of green-manuring (i.e., ploughing young green crops into the soil), and the application of farm-yard and kraal manure.

The observant pupil must have noticed that in different parts of a farm, or even in the same field, the soils are not always uniform

in composition and fertility. The explanation may be that part of the soil consists of alluvium transported from elsewhere, whilst the remainder has been derived from the underlying rock. Again, an infertile sandstone or limestone district may contain patches of fertility covering intrusions of dolerite.

Over South Africa as a whole, doleritic intrusions are most numerous in the interior of the country; or, more precisely, within an area extending from Ceres to Ermelo in one direction, and from Kimberley to Port St. John in another. This region therefore includes stretches of land of great fertility. The soils of the coastal margins, on the other hand, are relatively deficient in plant-food, and require to be fertilized artificially. In these areas sand and clay, both of which are essential to good soils, are on the whole present in the requisite proportions, but the amount of phosphoric oxide, potash, lime, and nitrogen is usually insufficient. Superphosphates, bone-meal, Karroo ash (burnt kraal manure), guano, ammonium sulphate and saltpetre are therefore employed to meet the deficiency.

The composition of the soil determines what form of fertilizer is necessary. Where excessive rains have dissolved lime out of the soil, as in the south and south-east coastal regions, it is usual to add lime or chalk in order to neutralize the acidity.

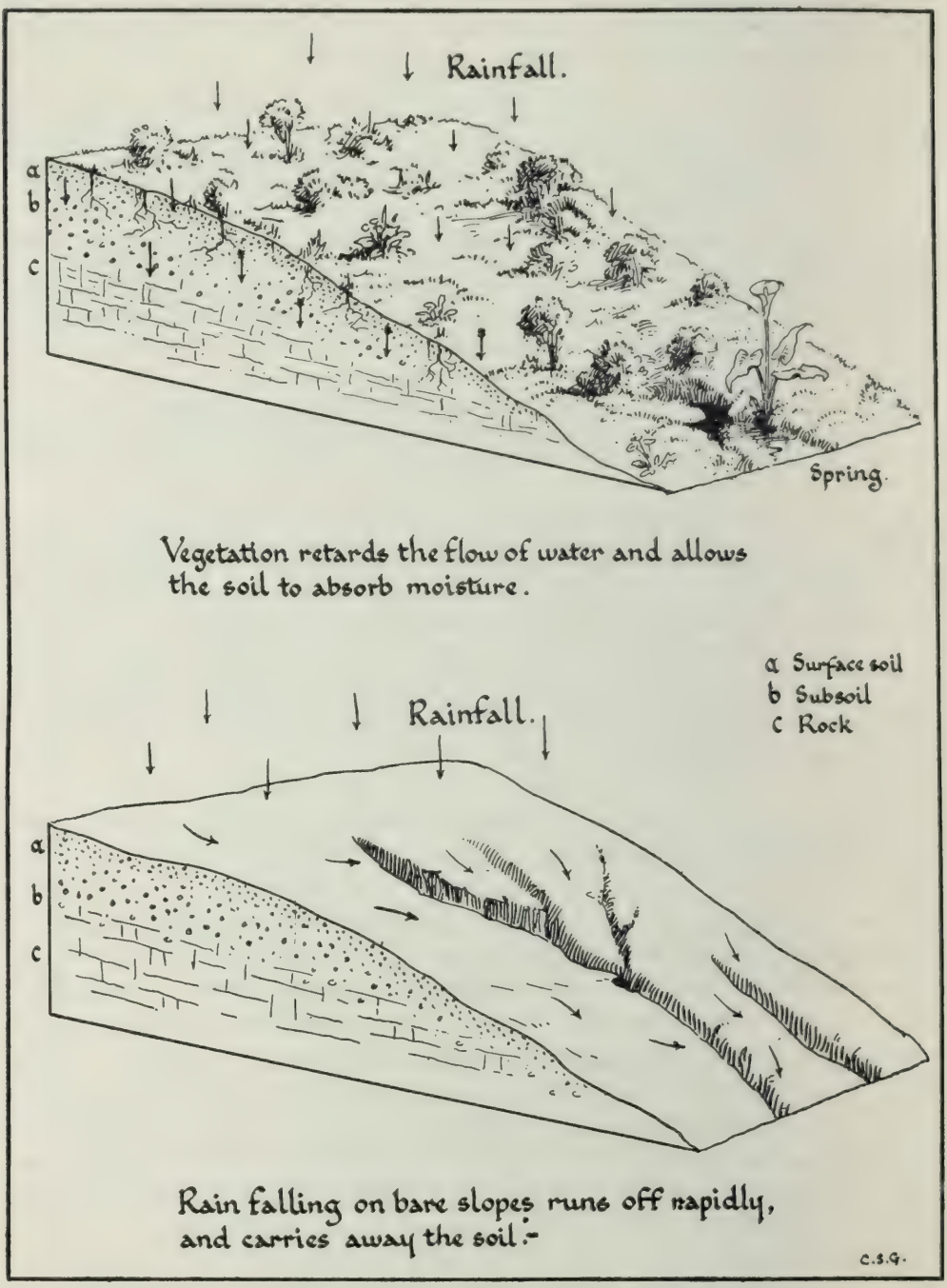
In many parts of South Africa brak soil occurs, containing an excess of alkaline compounds such as salt and sodium carbonate. This characteristic is common to arid regions like Northern Chile and parts of the Sudan, where the scanty rainfall has allowed the soil to retain its soluble elements. Occasionally the proportion of brak is so high that the salts reveal themselves as a white surface-covering. This condition, for chemical reasons, is not easily remedied by the addition of fertilizers. Nor does irrigation improve matters; for water thus added to the soil dissolves the salts and carries them in solution to a certain depth, only for the injurious alkali to creep upward again as the surface begins to dry.

Soil-Erosion, and the Conservation of Soil and Water. Many agencies are at work converting rock into soil, but wind and water tend also to the wasting and removal of soil. This process is known as soil-erosion. Evidences of it may be seen in the muddy turbid waters of streams in flood, in the denudation of steep slopes to the bare rock, in the dust-laden winds that blow in dry weather, and in the formation of dongas or sluits.

Running water is probably the most destructive agent. Much of the rainfall of South Africa occurs in the form of downpours of almost tropical violence, whilst owing to the high altitude of the river-sources streams flow with a swift current. An examination of eleven Karroo rivers during a flood period showed that the average quantity of soil carried in suspension amounted to $16\frac{3}{4}$ lb. per hundred gallons.

It is sometimes asserted that soil-erosion is not of serious consequence, because it merely enriches one region at the expense of another. While it is true that water-borne soil may produce rich alluvial flats elsewhere, a great deal is certainly carried to the sea and permanently lost. It is estimated that the soil washed

annually into the sea by South African rivers would cover 91 square miles 12 inches deep.



The formation of new soil by the disintegration of rock is so slow a process that one could readily understand its being exceeded by the loss of soil through erosion. In nature, however, the equilibrium is maintained by the growth of vegetation, which allies itself

with the soil and checks the wasting process. The roots of trees, of shrubs, and even of grass bind the soil together; whilst on sloping ground vegetation retards the flow of water, so that a large proportion of the rainfall soaks into the soil instead of washing it away. It would appear, therefore, that the destruction of surface vegetation interferes with Nature's balance, and results in the loss of enormous quantities of soil and water, the farmer's most valuable possessions.

Veldburning and overstocking are two potent causes of soil-erosion. Both natives and Europeans are guilty of the former, whilst considering the present poverty of the vegetative covering the native areas are grossly overstocked.

Veld-burning as a means of preparing land for the plough is not a serious evil, for the potash thus added to the soil renders it very fertile, and the tendency to erosion is checked, in the long run, by the substitution of cultivated plants for the natural flora. Farmers, however, often burn grazing-land, to get rid of dead grass and produce young green veld quickly. There is little to commend this practice; not only does veld-burning leave the soil loose and dry, but it returns to the air great quantities of carbon and nitrogen that would enrich the soil if the grass and bush were allowed to die down naturally.

Vegetation and soil are also wasted by overstocking; i.e., by allowing more animals to graze on a given area than the land can carry. When every scrap of vegetation has been eaten up, the hungry animals kick and trample the soil loose in their search for more. In this way perennial plants are uprooted and destroyed. It is believed that the deterioration of the veld in the south-western districts of the Orange Free State, where Karroo bush is beginning to invade the grass veld, is due to this cause.

The remedy for overstocking is not necessarily a reduction in the number of stock, but a more economical use of the veld. The Drought Commission's Report strongly recommends the abolition of the kraaling system, which results in the complete extinction of pasture in the neighbourhood of the kraal, in favour of a system of large fenced paddocks in which stock could range freely. Moreover, the provision of a windmill for raising water in each paddock would do away with the long journeys stock frequently have to make every day in order to drink. The dusty tracks made by sheep and cattle as they walk in single file from the kraal to the drinking-place become worn and loose, and are rapidly converted into sloots as soon as the drought is broken.

Although it does not follow that most soil is wasted in this manner, the formation of dongas or sloots is the most obvious and spectacular evidence of soil-erosion. They are caused, as

noted above, by the degeneration of roads and footpaths into water-courses, especially where the gradient is steep. Another cause is the practice of ploughing up and down a hill, instead of along the contours ; storm-water converts the furrows into streams.

The formation of dongas should be instantly checked, since they tend to multiply in size and number. A neglected sloot becomes deeper and longer, and may attain the dimensions of a small ravine, into which water drains from the adjacent lands, leaving them drier and still more subject to erosion. It may thus happen that a neglected donga is joined by tributary dongas, until, unless the process is checked, a large area becomes completely dissected by water-channels. The prudent farmer therefore throws obstructions across newly-formed sloots, in order to arrest the silt and fill up the gully ; walls and dams, sometimes planted with shrubs, or wire-netting filled with earth, stones, and brush-wood, are used for this purpose.

It should be noted, finally, that the conservation of soil and vegetation is intimately related to the conservation of water. A vegetal covering shelters the surface of the ground from wind and heat, and therefore checks evaporation, whilst the roots of plants, striking down to the sub-soil, make it porous and absorbent. In a word, plant-growth renders rainfall more *effective*.

An example from the Drought Commission's Report well summarizes the whole problem of soil-erosion and the conservation of water. A farm in an eastern district of the Orange Free State contained beautifully-wooded mountain slopes, but cattle were fond of going under the trees for shade, and became infected with ticks. The owner therefore set all the kloofs and mountain-slopes ablaze ; the tick was eradicated. But in a few years the aspect of the district had entirely changed. The mountains were destitute of all vegetation ; the springs were drying up ; whilst the hill-slopes had become a network of sloots, by which all the rainfall and much of the soil were being carried down to the Caledon River, and thence to the sea.

Irrigation. The prosperity of South Africa having been founded mainly upon mineral resources, it is urgently necessary to promote agriculture, so that the diminishing output from the rocks may be balanced by increased production from the soil. Since farmers, however, have to contend against deficient and irregular rainfall, agricultural expansion can only be achieved through man's ability to conserve and employ the available water-supply of the country in a more effective manner than under natural conditions.

The progress of irrigation in the Union is hampered by numerous difficulties, some of which confront irrigation projects in general,

whilst others relate to particular methods of irrigation. There are three natural hindrances of a general character :

(1) Irrigation depends ultimately upon rainfall, which over large areas of South Africa is capricious and insufficient. Even districts with a fairly high mean annual rainfall are not altogether free from drought.

(2) Moreover, although throughout the coastal regions of the east and south rainfall is fairly abundant, there is no natural or artificial means by which the surplus can be utilized to the advantage of the lofty arid regions of the interior.

(3) South Africa, owing to its latitude and relief, possesses no regions of permanent snow, and therefore lacks the advantages to irrigation of countries like Mesopotamia and the Punjab, where rivers, rising in vast fields of snow and ice, spread fertility over almost rainless regions.

Particular methods of irrigation employed in South Africa will now be discussed briefly.

A. *The use of subterranean water supplies.* Boreholes yield nearly 80 million gallons daily. This total is small, however, considering the needs of agriculture, and cannot be compared with the yield from the artesian area of Australia, whose structure, in contrast to that of South Africa, is favourable to the accumulation of vast underground reservoirs by percolation from wetter and more elevated districts. In South Africa windmills and motors are usually necessary to pump the water up the boreholes ; under true artesian conditions water is forced to the surface by natural pressure.

B. *Flood irrigation.* This system of irrigation, of which Egypt affords the most notable example, has the merit of constantly re-fertilizing the land with the silt deposited by flood-waters, but can be carried on only where the lands adjacent to a river are flat, and where floods are of periodical occurence. Since these conditions are present in South Africa only to a limited extent, flood irrigation is not commonly practised. Over limited areas the system is employed in the district between *Fraserburg* and *Calvinia*, watered by the Zak and Fish Rivers, and in the districts of *Kenhardt*, *Cradock*, and *Somerset East*. Streams in these areas are allowed to overflow the surrounding agricultural land ; low embankments are built to retain the flood-water, which if sufficiently abundant may be released after a few days to irrigate lands further down-stream. The system is sometimes known as *saaidam* irrigation ; the irrigated plots are called

saaidamme. These plots are sown, usually with wheat, barley, or lucerne, immediately the flood waters subside or are released.

Flood irrigation has its disadvantages and limitations. A year may pass without a river once coming down in flood ; again, the cultivation of certain crops, e.g., citrus, requires not merely one flooding, but regular irrigation throughout a long period.

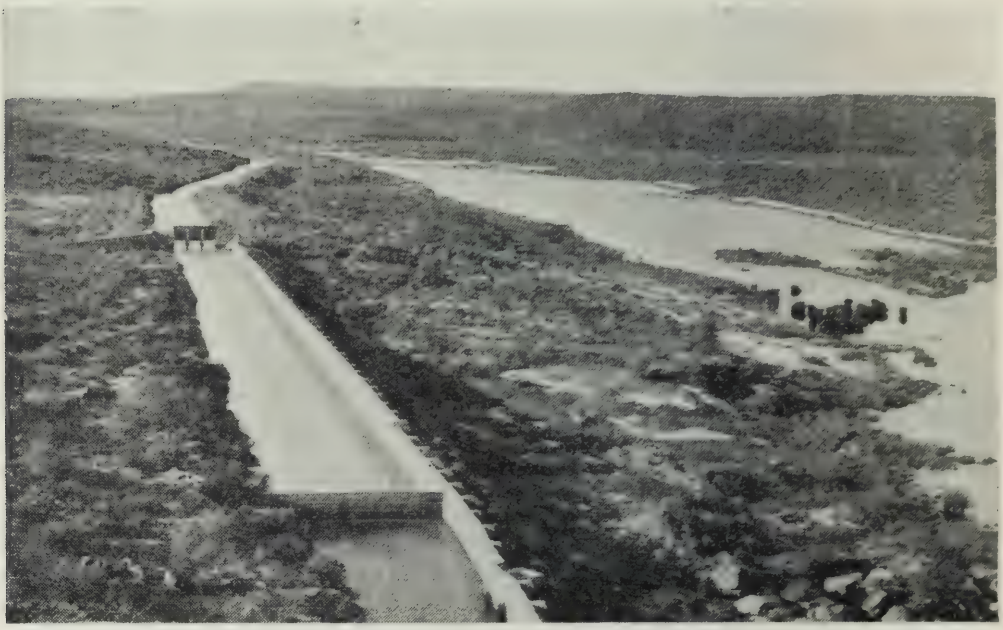


Photo.] [*S.A.R. Publicity Department.*

IRRIGATION, BRITSTOWN.

C. *Irrigation by the diversion of streams*. This type of irrigation involves the construction of a netword of canals and furrows, by which the water of a river is diverted over the adjacent lands ; the system is widely practised throughout the world. In South Africa, however, streams have frequently cut valleys that are so much below the level of the surrounding country that in such cases diversion schemes are not practicable. They occur in greatest number along the valleys of the Breede, Olifants, and Great Fish Rivers, and between *Upington* and *Kakamas* on the Orange River ; but since diversion, like flood irrigation, is dependent upon seasonal conditions, it is rapidly being superseded by schemes based upon conservation, or storage.

D. *Perennial irrigation, by the construction of conservation works*. This is the most successful form of irrigation now employed in South Africa. Owing to the great expense involved—the Hartebeestpoort Reservoir cost £1,600,000—large storage schemes have

in most cases been carried out by co-operative groups of farmers by means of Government loans.

The Hartebeestpoort Dam, west of Pretoria, involved the building of a massive concrete wall nearly 200 feet in height, where the Crocodile and Magalies Rivers break through a narrow poort in the Magalies Range. This dam, the largest in South Africa, has a storage capacity of 5,000 million cubic feet, and irrigates a large area between Rustenburg and Pretoria. The *Kamanassie Dam* is situated upon the river of that name which flows westwards between the well-watered Outeniqua and Kamanassie Mountains. Canals connected with it have a total length of 110 miles and afford the main source of irrigation in the *Oudtshoorn* district. The Sundays River is utilized for conservation works at *Van Ryneveld's Pass*, near Graaff-Reinet, and again at *Lake Mentz*, 42 miles below Jansenville ; the latter is the second largest dam in the Union and helps to make the lower part of the Sundays River basin the productive region that it is. Other important reservoirs are those of *Grass Ridge* and *Tarka*, dependent upon tributaries of the Great Fish River, and the *Tyger-poort Dam*, on the Kafir River, 22 miles south of Bloemfontein. Many still more comprehensive projects are under consideration. A new dam, 50 sq. miles in area, is to be constructed at Knoppies-fontein, in the Southern Transvaal.

Two main difficulties inherent in large conservation works may be noticed :

(1) They are extremely expensive, both to construct and to maintain. The cost of maintenance arises chiefly from the enormous quantity of silt carried by most South African rivers. This silt accumulates in the reservoirs and gradually fills them up. Thus between 1910-20 it was estimated that silt accumulated in the Bongola Reservoir (Queenstown) to the extent of 51 million cubic feet ; in 1919 Bloemfontein found itself without a water-supply from this cause, the reservoir having completely filled up. Thus reservoirs can only be maintained at full capacity by means of elaborate dredging operations.

(2) The dry atmosphere over the greater part of South Africa absorbs a vast amount of water from the reservoirs by evaporation. Whereas in London the annual evaporation from a free water-surface is equivalent to a depth of only 15½ inches, in Kimberley the loss amounts to more than 8 feet. Bearing in mind the extent of some of our large reservoirs—Lake Mentz has a surface area of 7½ sq. miles—it will be evident that the total loss by evaporation s a serious factor.

It is estimated by responsible officials that it would be practicable to irrigate about a million acres of the total area of the Union. Not all this irrigated land, however, would shew a profit. Moreover, the total irrigable area is not really large ; in India the Lloyd Barrage alone irrigates five million acres. It is because further irrigation schemes are not likely to add enormously to the Union's agricultural production that some authorities look elsewhere for a solution of our drought problem. Thus the late Professor Schwarz, in a provocative book, *Thirstland Redemption*, suggested that during the last century South Africa has been drying up, probably as a result of the disappearance of large sheets of water in Northern Bechuanaland and Ovamboland. These lakes, he considered, could be re-constituted by diverting water from the Cunene, Chobe, and Okavango rivers, " forming an evaporating surface supplying rain-clouds for the whole of South Africa." Opponents of the Schwarz scheme question whether the ancient lakes could be recreated by clearing the channels which connect them with the rivers, and assert that the apparent drying up of South Africa is due not to reduced rainfall but to increased run-off. The pupil is advised to read *Thirstland Redemption* for its wide views and original ideas, remembering, however, that many authorities have not been convinced that the project would be successful.

CHAPTER VII.

FARM PRODUCTS AND FARM INDUSTRIES.

A question often raised in South Africa is that of the relative importance of farming and mining.

The question does not admit of a simple answer. Even a superficial glance at our external trade shows the great importance of mining ; for our gold and diamonds, which form a large proportion of our exports, pay for most of the commodities we have to import.

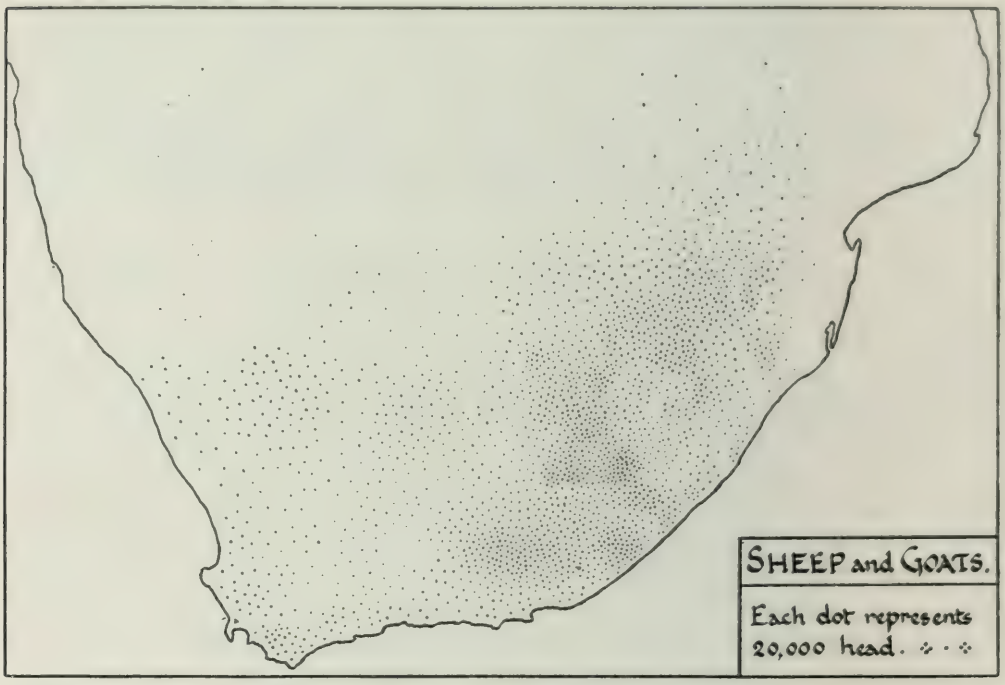
But from other points of view the more important industry is farming. It supports four times as many white families as mining, and contributes twice as much to the support of the native population. Moreover, the value of the agricultural and pastoral production usually exceeds that of the mineral production by £30,000,000. Thus farming provides a livelihood for more people than mining, and adds more to the national wealth. It must also be borne in mind that mining in South Africa is a highly-developed industry, whereas scientific farming has been comparatively neglected, and is capable of great expansion. The good results of agricultural education, irrigation, intensive farming and co-operation are only just becoming apparent. Again, whilst railway construction half a century ago was determined largely by the distribution of minerals, the present tendency is to provide means of transport that will benefit the farmer. It may be expected, therefore, that in future the superiority of farming over mining will be relatively greater than at present.

The principal farm industries will now be described, attention being drawn to the fact that pastoral produce (wool, meat, milk products, hides, mohair, etc.) is of much greater value than agricultural produce (maize, wheat, sugar, etc.) ; for, owing to our insufficient and unreliable rainfall, less than 15% of the Union consists of arable land.

Sheep and Goats. The sheep indigenous to South Africa is a fat-tailed animal which yields mutton of good quality but whose fleece resembles hair rather than wool. Cape sheep, as they are called, at present constitute about one-sixth of the total number of sheep in the Union. Vigorous and hardy, they are comparatively immune to disease, and thrive in arid districts like the north-western part of the Cape Province and the Western Karroo.

Woolled sheep were first introduced from Holland by the Dutch East India Company, about the end of the 17th century. At a later date sheep from Britain and other countries were brought over, of special importance being the fine-woolled Spanish merino breed. During recent years noteworthy importations of Australian sheep have taken place.

Since the pure merino, although producing fine wool, yields inferior mutton, many South African farmers prefer a cross-bred



type of animal, whose wool is of moderate quality and whose flesh is sufficiently palatable. The tendency, however, is to approximate more and more to the true merino type, with a view to the production of wool that will fetch higher prices in the European market.

Woolled sheep differ from Cape sheep in that they require better pasture. They are accordingly most numerous in the Eastern Karroo, in the south-eastern region of the Cape Province, in the eastern half of the Orange Free State, and in the South-Eastern Transvaal. In 1930 the distribution of sheep (in millions) was as follows:

Cape Province	*Orange Free State*	*Transvaal*	*Natal*	*Total*
27·1	12·9	5·6	2·9	48·5

Sheep have a remarkable capacity for thriving upon veld possessing very little succulent vegetation; they find sustenance, for example, in the dry shrubs and bushes of the Karroo regions.

For this reason sheep are often treated in a somewhat negligent manner. It is still the practice, for example, to trek sheep immense distances, sometimes from one province to another, in order to find pasture or to escape the rigours of winter. The system is wasteful; large numbers of stock are lost through starvation and exhaustion, the flocks are frequently attacked by disease whilst traversing infected districts, and in any case the value of

Photo.] [*S.A.R. Publicity Department.*

SHEEPFARM, KARROO.

the wool is diminished by the dust it acquires during such wanderings. A more satisfactory plan is to keep flocks in the same district throughout the year, providing them with forage, and, if necessary, shelter during the winter season.

Sheep are subject to various diseases, the most serious of which is known as scab, a highly infectious disease which destroys the wool. The remedy is to immerse the infected animal in a tank containing an insecticide, the process being known as 'dipping.' Scab is so dangerous that when an infected sheep is discovered, the rest of the flock are dipped and then quarantined for a period. Dipping has been made compulsory in many districts, and in 1925 it was considered necessary to carry out simultaneous dipping throughout a large area, only certain 'protected districts' being exempt from the order.

Another menace to sheep-rearing in South Africa is the jackal, said to be responsible for the loss of 300,000 sheep annually. This marauding animal compels the farmer to kraal his flocks at night, a system roundly condemned by the Drought Commission as unnatural and wasteful. It is more natural for sheep to graze morning and evening, and to rest during the day ; this is impossible under the kraaling system. Again, sheep-kraals are usually so dirty and overcrowded that considerable losses occur, particularly among the lambs, through trampling and infection.

It is better, and ultimately cheaper, to allow sheep to run day and night in large paddocks or enclosures, suitably fenced against jackals. A sheep farm managed in this way would be divided into fenced enclosures, each being rested from time to time to allow the veld to recover.

The important marketable products of the sheep industry are wool, mutton, and skins, although a few live animals are exported to neighbouring African states. The wool-clip is almost entirely exported, principally to Britain, France and Germany. The value of our wool exports varies greatly according to the price of wool ; in recent years the average has been about £12,000,000. Port Elizabeth and East London share the greater part of this trade about equally. Cape Town's share is small, owing to its remoteness from the more important grazing regions.

The production of mutton and skins cannot be estimated exactly, for the agricultural census gives only the quantities, not the values, of commodities. Since, however, both the imports and the exports of mutton are negligible, it is evident that sheep are slaughtered in just sufficient numbers to meet the home demand. Until recently, frozen mutton was imported. Normally sheepskins to the value of £1,500,000 are exported, mainly to Britain, France, and the United States of America.

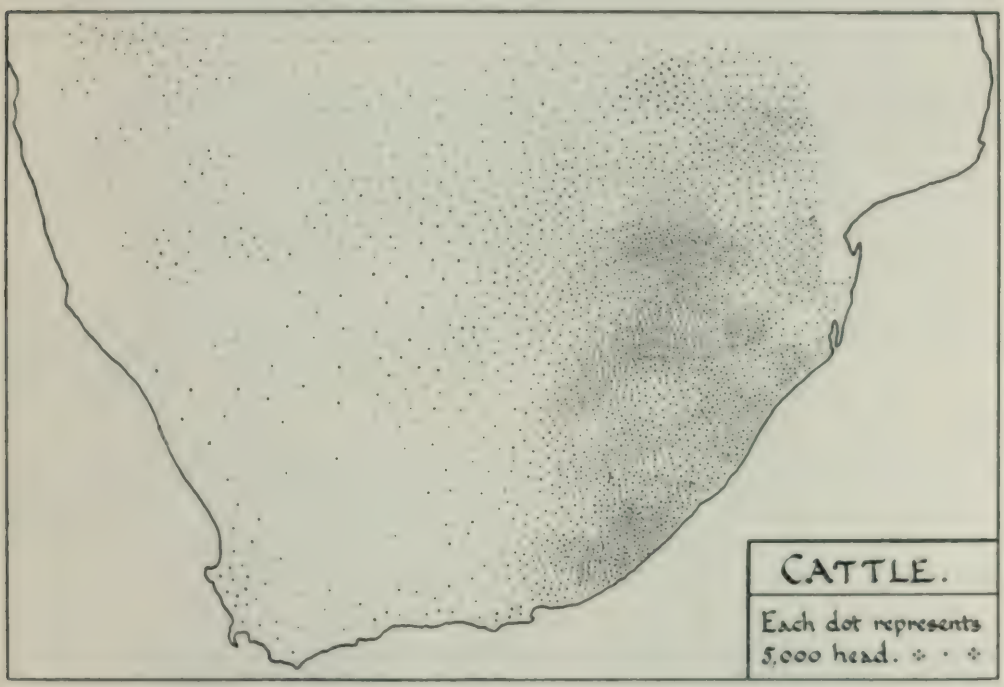
There are about 8 million goats in the Union, Angoras comprising a quarter of this number. The Cape goat, which is even hardier than the Cape sheep, is able to maintain itself in apparently waterless regions. It is reared for its milk, flesh and skin, and forms the mainstay of the poorer inhabitants of the arid northern and western districts, outside which it is found only in the native territories.

The Angora goat, introduced during the last century from Asia Minor, has a long silky fleece—the mohair of commerce. At the present time South Africa and Turkey share the world-production of mohair. Exports vary in value from £300,000 to £1,000,000 annually. The industry is centred mainly in the Cape Midlands.

Cattle. The cattle and dairying districts of South Africa do not cover so wide an area as the sheep districts, for cattle require richer pastures, while certain types thrive best in lowland regions.

Comparing the maps showing the distribution of sheep and cattle with the rainfall map, it is apparent that whereas the former are dispersed over the country with some degree of uniformity, the latter show a concentration to the east of the 15 inch isohyet.

The suitability of large areas for the livestock industry is attested by the abundance of game that roamed the sub-continent in former times, and also by the rapidity with which the cattle population has on several occasions recovered after severe losses brought about by war and disease.



The increasing world-demand for beef provides South Africa with a great opportunity. As has already been shown, 85% of the Union is fit only for pastoral production. To encourage the rearing of beef-cattle, meat export bounties have been granted by the Government, and a beginning has now been made in the export of chilled beef and livestock to England. Beef to the value of £250,000, of which one-half came from Rhodesia, was exported in 1931, mostly to Italy.

It is improbable, however, that South Africa will ever export beef and dairy produce in such enormous quantities as are at present exported to Western Europe by Australasia and the Argentine. In comparison with these countries South Africa suffers certain disadvantages, and, although some of these are capable of being removed, others are inevitable.

In the first place, pastoral farming in South Africa was not, in the past, an organized industry; it was rather a means of existence involving a minimum of industry. The settler was content if his flocks and herds brought him a reasonable subsistence; the allurement was not wealth, but independence, and the solitude of vast spaces.

The second difficulty is the prevalence, to a degree almost without parallel elsewhere, of stock diseases. Infestation from the tropical regions of Africa, and the fact that about half the cattle of the country are native-owned, are probably the principal causes. In Natal, for example, stock-losses during the years 1897-1911 were in some years 60% of the total cattle population of the province for the year. Rinderpest and East Coast fever were mainly responsible. Dipping, inoculation, and other preventive measures are now making headway against stock diseases, and by the importation of thoroughbred animals, which are frequently crossed with the hardy indigenous cattle, both ranching and dairy herds are being improved.

Thirdly, the dominant aspect of stock-raising in South Africa has been the need for draught (*i.e.* transport) cattle. Even to-day agricultural districts are so poorly served by the railway system that ox-transport is one of the chief means of conveying produce from remote farms to the railhead. The meat and dairying industries accordingly suffer.

Finally, for reasons explained elsewhere, the soils and grass-lands of South Africa are now in worse condition than when the European first arrived. During periods of drought and in the dry season there is a lack of food, and it is not yet a common practice for farmers to keep in reserve adequate supplies of fodder. On the contrary, whilst in periods of drought cattle die in thousands, or are being seriously weakened in condition, a vast quantity of maize is exported.

Most of the cattle at present reared in South Africa are cross-bred between descendants of the slightly-humped animals indigenous to the country and stock introduced from Europe. From 1780 onwards both Dutch and British types have been imported; about 45% of the pedigree stock are Frieslands, 22% Shorthorns, 17% Afrikanders, and 8% South Devons. Frieslands predominate everywhere except in the west of the Union, where the hardy Afrikanders are more common, and in the Eastern Province of the Cape, where Shorthorns are most numerous.

Only one-tenth of the cattle in the Union are of the improved type (i.e. bred from pedigree stock and graded); the remainder, called scrub-cattle, have not been bred for a specific purpose. 70% of the improved cattle are found in the High Veld regions of the Transvaal and the Orange Free State, and in the Natal Midlands.

From 1904 the number of cattle in the Union increased in 20 years from $3\frac{1}{2}$ millions to 9·6 millions; in 1930 the distribution was as follows:

Cape Province	*Transvaal*	*Orange Free State*	*Natal*	*Total*
3·4	3·2	1·7	2·5	10·8

Of this total 50% were native-owned.

Ranching demands cheap land, good grazing throughout the year, a sufficient water supply, cheap stock and a sensible breeding policy, and proper veld management. Potential ranching areas are the Low Veld and Bechuanaland; from these areas cattle would be sent to the maize districts for fattening, as is customary in the U.S.A. and elsewhere.

The production of butter, cheese, and condensed milk has greatly increased during recent years. Whereas these products were formerly imported, there is now a surplus for export. Since the economical production of butter requires specialized premises and appliances, about one half the butter-fat produced in the Union is sold to co-operative dairy associations and creameries possessing these facilities.

Dairy-cattle number about 750,000; they are most numerous in the Eastern Grasslands of the Cape, the Natal Midlands, parts of the winter-rainfall area, and in the neighbourhood of large towns.

Dairying produces good profits from a small acreage; for milk-production, unlike agriculture, removes little from the soil, whilst the manure maintains fertility. But the industry requires more capital than ranching, and needs skilled, and clean, labour. Again, the high temperatures of South Africa favour the growth of micro-organisms, so that refrigerating plant has to be used. There is also the difficulty of making good food-deficiencies during the dry period.

Condensed milk is manufactured in Natal and in East Griqualand.

Ostrich Farming. The ostrich is indigenous to many parts of Africa, but the plumage of wild birds is of no great value. It was known, however, that feathers of superior quality could be obtained by careful feeding and breeding, and accordingly about the year 1860 ostrich-farming came into existence as an organized industry.

Ostrich-farming has been confined almost exclusively to certain irrigable districts of the Cape Province, for the reason that while the birds thrive best in dry sunny regions, the growth of good feathers requires a more nourishing diet than desert conditions afford. Ostriches are therefore most successfully reared in the Little Karroo, particularly in the *Oudtshoorn* district, and in districts along the Sundays and Great Fish Rivers, where natural pasture can be supplemented by grain and lucerne grown by irrigation. During the time feathers are growing the birds are kept in paddocks and highly fed; after clipping, they are turned out to graze on the veld.

The most valuable part of the plumage consists of the wing feathers, which are plucked about once a year.

Ostriches multiply faster than most kinds of farm stock, and are comparatively immune to disease; hence for many years the industry expanded rapidly. In 1913 the number of ostriches in the Union reached the total of 780,000, and the value of feathers exported nearly £3,000,000. A disastrous depression, due to

overproduction and to changes of fashion, followed this prosperous period ; in 1930 the number of birds had fallen to 32,000, whilst the export of feathers was valued at only £43,000. The feather industry has shown, more cogently than any other branch of farming, how imprudent it is for the South African farmer to concentrate on one kind of farming to the exclusion of others.

Transport Animals. Several factors have encouraged the breeding of draught animals in South Africa ; notably the lack of inland water-transport, and the insufficiency of railways in pastoral and agricultural districts. The animal most commonly employed is the ox, which is of particular value because it is patient, is less nervous than the horse, and requires less food. But the fostering of the beef and dairying industries tends to the increased employment, for transport purposes, of horses, mules and donkeys.

A large area of South Africa produces pasture suited to the breeding of these animals ; the only unfavourable factor is the prevalence of horse-sickness, a mysterious disease of periodical recurrence. Horse-breeding is carried on principally in the eastern divisions of the Cape Province and the Orange Free State, and in the South-Eastern Transvaal.

Arab and Persian horses were brought from Java nearly 300 years ago, and were the first domesticated animals to be introduced into the country. Subsequent importations have included Spanish, American, and British thoroughbreds. In this way South Africa has evolved, upon her own grasslands, a distinctive type of horse : a well-bred, vigorous, though somewhat small-sized animal.

The export of horses, principally for remount purposes, dates back to 1769 ; India, Egypt, and the tropical countries of Africa have been our principal markets. South African horses were the first to be introduced into Australia.

Mules are hardier than horses and have a longer life. They are most numerous in the Mediterranean region of the Cape, where the rapid growth of large farming communities has demanded a form of transport more rapid than that provided by draught oxen.

Large numbers of donkeys are reared in Bechuanaland and in the Transvaal Middle Veld ; Vryburg and Kuruman are the chief markets.

Camels are rarely seen in South Africa, only a small area of which consists of sandy desert, the true home of these animals. Camel transport, however, has been used in Bechuanaland and in South West Africa. The Southern Kalahari mail used to be carried by a camel.

Poultry Farming and the Rearing of Pigs. Both these branches of farming should be associated with fruit growing, dairying, and the cultivation of grain and lucerne ; for they provide a means whereby field and orchard products not suitable for the market may be utilized to advantage. Again, the by-products of the dairy are especially valuable for pigs, and to a lesser degree for poultry. A further reason for mixed farming of this kind is that it tends to stabilize a farmer's income ; for example, a dry season is bad for fruit, but favours poultry farming. But whilst there are many scientifically-conducted farms devoted only to poultry, the value of poultry-farming as subsidiary to other kinds of farming is not generally realized.

It is believed that the dry, sunny climate of South Africa is particularly suited to poultry-farming. The industry has benefited greatly by the introduction of the Danish system of Co-operative Egg Circles.

Although pig-rearing is still in the experimental stage, it has been established that in some areas the industry can be a very profitable one. Pigs are extremely prolific, thrive well on farm-refuse, and can be reared without large investments of capital. The curing of bacon and ham are expanding industries, but although there is an export of these articles, imports are still greatly in excess.

PRODUCTS OF CULTIVATION.

MAIZE. Maize is the principal field-crop of South Africa. It forms the staple food of the native population; it is valuable for stock, and is cut for ensilage; there is also a large surplus for export. The increasing cultivation of the cereal as a fodder-crop to supplement grazing will probably lead to more extensive stockfarming, and hence to developments in the export of meat and dairy-produce.

The climatic conditions favourable to maize-cultivation differ essentially from those which govern wheat-production. Maize requires a summer rainfall of at least 24 inches, a temperature during the ripening period of 75°, and a growing period of 200 days free from frost. The western limit of cultivation is therefore a line drawn approximately from Mafeking to East London. To

the East of this line maize is grown successfully in the following areas :

(1) The Transvaal High Veld ;
(2) The Orange Free State ;
(3) The Midlands of Natal ;
(4) The Eastern part of the Cape Province.

Actually the area of greatest production is a triangle whose three corners are Ladybrand, Bethal, and Lichtenburg. Within this triangle are located nearly all of the country elevators utilized for maize.

Climatic conditions in South Africa are so ideal for maize-farming, particularly by reason of the abundance of sunshine, the comparative freedom from frost during the growing season, and the absence of rain while the grain is maturing during the autumn, that the quality of our maize is not surpassed in any part of the world. In respect of quantity, however, South Africa's position is a very subordinate one ; the United States' output is about 40 times greater, whilst even in Mexico and in many of the states of Central Europe there are larger crops. Nevertheless, production during the period 1910-31 increased steadily from 800,000 tons to about 5,000,000 tons. Further expansion could be effected by raising heavier crops per acre. The greater part of our mealie crop is produced on large farms employing a minimum of labour ; the American farmer, with less land to cultivate, adopts ' intensive ' methods, *e.g.* frequent ploughing, and the use of fertilizers. Hence in the United States the average yield per acre is 26 bushels, compared with a South African yield of 14 bushels.

The transport of maize to the coast, together with the subsidiary processes of cleaning, grading and storing, constitutes a highly-organized industry. There is probably no other branch of farming in which marketing facilities are so perfect. Instead of arranging privately for the transport and sale of his mealie crop, which would be troublesome and uneconomical, the farmer sends his grain to a neighbouring elevator, receiving in return a receipt stating weight and grade. According to this system the farmer has not yet sold his crop, although banks advance loans against elevator-receipts. Once in the elevator, quantities of maize handed over by different farmers lose their separate identity, for the grain is now handled in bulk by the Railways and Harbours Administration. At present, there are 34 country elevators used for maize. Their capacity varies from 1750 to 5800 tons. Port elevators have been built at Durban (42,000 tons) and Cape Town (30,000 tons).

The handling of maize at the port elevators is highly efficient. Some of the grain is bagged for export to countries lacking the dock facilities necessary for discharge in bulk. Most, however, is conveyed from the elevators directly to the hold of a ship by a broad horizontal belt, travelling rapidly along a ' shipping gallery.' In this way maize is loaded in bulk at the rate of a thousand tons an hour.

Maize is the principal agricultural export of South Africa, although the proportion of the maize-crop exported varies from year to year. By the Maize Quota Act (1931) there is a compulsory export of the estimated surplus, in order to maintain the local price.

Maize plays the same part in the economic life of the South African grain farmer as that played by wheat in the life of the Canadian farmer. It must be understood, however, that whilst

to us the maize crop is of great importance, the Union does not seriously compete, either in total production or in exports, with the countries of North and South America. There can be no doubt that if every bag of maize grown in South Africa were utilized in South Africa, chiefly for the feeding of cattle, the country would be more greatly enriched than by the present method of enforced export.

Photo.] [*S.A.R. Publicity Department.*

GRAIN ELEVATOR, CAPE TOWN; Table Mountain in background.

WHEAT. The conditions that govern successful wheat production may be summarized as follows:

(1) During winter and spring there should be a moderate rainfall; but for the grain to ripen without interference from parasitic diseases, such as rust, the summer should be relatively warm, dry, and sunny.

(2) The soil should be stiff enough to support the stalk.

(3) The land, although well-drained, should be sufficiently flat or gently-undulating to permit the use of field-machinery.

The first and most important of these conditions occurs only in the winter-rain region of the Cape; yet the cultivation of wheat is so protected, the price being fixed by the Government,

that it is carried on in regions where adverse climatic conditions prevail, e.g., in the Caledon Valley, and in the eastern districts of the Cape Province. About two-fifths of the total yield is obtained from the winter-rain region.

Of the 512,000 morgen under wheat, the Cape Province has 65%, the Orange Free State 25%, and the Transvaal nearly 10%. The area in Natal is less than 500 morgen.

Even in the south-western districts, where climatic conditions are favourable, the average yield per acre is less than the yield in other wheat-growing regions of the world. Inferiority of soil is mainly responsible. Moreover, in some areas production is actually declining; for where farmers have neglected to return to the soil, in the form of fertilizers, the elements which successive harvests have taken from it, crops are becoming progressively poorer.

In order to ensure sufficient moisture during the growing season, wheat is sown in the winter-rain region from April to June. Reaping begins in November. Many farmers use a variety of seed, and sow the various kinds successively over different lands, in order to distribute the labour of sowing and harvesting over as long a period as possible. *Moorreesburg* has a small wheat elevator.

The heaviest crops are obtained from the *Malmesbury*, *Caledon*, *Moorreesburg*, *Bredasdorp*, and *Piquetberg* districts. Both to the north and to the east of the region embracing these centres wheat-cultivation becomes a somewhat speculative enterprise. To the north and north-east rainfall diminishes rapidly; the yield from the *Calvinia* and *Van Rhyn's Dorp* districts is variable and uncertain. Eastwards wheat is grown in the Breede River valley, the chief centre being *Swellendam*; but beyond this point the ripening of the grain, as well as harvesting operations, are apt to be hindered by summer rains.

Practically no wheat is imported, and since the Government, to encourage wheat-growing, fixes the price of wheat at a level considerably higher than the world-price, bread in South Africa is twice as expensive as in some countries.

Kafir-corn. The name kafir-corn is applied in South Africa to a cereal usually known as millet, or in some parts of the world as sorghum or durra. There are several varieties, some of which are indigenous to South Africa. Indeed, kafir-corn from this country has been successfully introduced into the drier regions of the United States.

In South Africa the region of greatest millet production coincides with the maize-producing area; although, owing to its ability to withstand drought, the cultivation of millet in the western dry-lands would help to extend the live-stock industry in this region.

Barley. This cereal is useful mainly as a forage-crop for dairy cattle. For this purpose it is often sown together with field-peas. Although of wide-spread occurrence, barley is most successfully cultivated in the south-west of the Cape Province, and in the Lydenburg district of the Transvaal. 20% of the crop is converted into malt. Barley suited to malting is grown under irrigation in the valley of the Breede, on the Little Karroo, and near Klaver.

Oats. Oats is a hardier cereal than wheat, and will grow in poorer soil. In South Africa wheat and oats are often grown in rotation. The chief importance of oats is to provide forage for cattle, horses and sheep. Much is sold in the form of oat-hay. Farmers even sow the cereal merely to provide grazing, especially in the eastern districts of the Orange Free State.

RYE. Rye is probably the hardiest of the cereals, and will grow in the poorest soils. Its cultivation is restricted to lands in the Mediterranean region of the Cape and in the Orange Free State which are not suited to the more valuable cereals. The total production of rye is less than one-tenth of the wheat crop. Its meal is used chiefly as food for pigs.

FRUIT. The cultivation of fruit on a large scale in South Africa dates back to 1892, when the Hex River Valley, like Mediterranean regions elsewhere, began to realize its advantages as a fruit-growing district. The industry has expanded rapidly, and is now carried on not only throughout the winter-rain region, but in many other parts of the Union. At the present time even the Transvaal and Orange Free State are building up a considerable export trade, refrigerator trucks being used for the journey to the coast; the latitude of these provinces gives them an earlier ripening season.

The position of South Africa gives her a unique opportunity to develop still further her fruit export trade. Situated in the Southern Hemisphere, her orchards bear their crop during the northern winter, when, with the exception of oranges, scarcely any European or North American fruit is obtainable. Moreover, the orange harvest of the Northern Hemisphere extends from November to June, during part of which period oranges are not greatly appreciated as a means of refreshment; South African oranges, on the other hand, ripening from June onwards, may be marketed at a more favourable time, viz., during the European summer.

This advantage of position does not apply to Australia, owing to her remoteness from Europe and the injury which fruit suffers in the course of the long voyage through the tropics. But South Africa finds strong competitors in Brazil, whose ports are much nearer Europe, and in the Argentine, whose ports are no more distant.

The South African fruit-grower, however, has difficulties to contend with. Disease is prevalent in all fruit-districts; the conditions favourable to fruit-growing are also favourable to the existence of insect-enemies and fungus. Such pests, however, can usually be controlled, provided the fruit-farmer makes use of the trunk-traps, sprays, and other devices recommended by the Department of Agriculture.

A more serious menace is hail, which not only destroys fruit but batters the trees so severely that their bearing-capacity may be reduced for several seasons. Damage due to hail is estimated at £500,000 annually. It is believed that hail falls only from clouds highly charged with electricity, and the experiment of erecting high towers or masts, fitted with copper ribbon by which the electricity may run to earth, is said to have been successful in securing immunity from hail for limited areas.

Another minor problem confronting the farmer who takes up fruit-growing is the period that must intervene between the planting of young trees and the first fruit-crop. This waiting-period is usually about five years; in the meantime the farmer supports himself by cultivating 'catch-crops' of tobacco, lucerne or vegetables between the young trees, or by poultry-farming and the rearing of pigs.

Fruit grown in South Africa may be classified as deciduous, citrus, and sub-tropical. The first-named class includes, in order of value, pears, grapes, peaches, plums, apricots and apples. The chief deciduous districts are as follows :

Cape Province ...	*Paarl, Worcester, Stellenbosch, Robertson, Tulbagh, Montagu, Ceres, Caledon, Prince Albert, Oudtshoorn, Bathurst.*
Transvaal	*Potchefstroom, Middelburg, Rustenberg, Ermelo, Heidelberg, Standerton.*
Orange Free State	*Ficksburg, Senekal, Winburg, Bethlehem, Bloemfontein.*

Citrus fruits, comprising oranges, naartjies, grape-fruit and lemons are native to sub-tropical summer-rain regions, and are grown mainly in those parts of South Africa where such climatic conditions prevail. Orange trees are cultivated also in the deep sheltered valleys of the Mediterranean region, where the fertile soil and warm sunshine, assisted by irrigation during summer, produce good crops. The following districts are most important :

Cape Province	*Paarl, Bathurst, Clanwilliam, Uitenhage, Somerset East.*
Transvaal ...	*Barberton, Rustenburg.*
Natal	*Weenen* and *Coast Region.*

Pine-apples, bananas and other sub-tropical fruits are grown in the wet coastal region extending from Port Elizabeth north-eastwards into Natal. The first-named form the chief crop of the *Albany* and *Bathurst* districts, and are largely exported, both fresh and canned. Bananas are cultivated in Natal, principally by Indians, but are not exported.

The drying and preserving of fruit are industries carried on mainly in the Mediterranean region, which in comparison with other fruit districts of South Africa enjoys the advantages of a dry summer and the concentration of highly-productive orchards within a small area.

The Vine. The vine was introduced into South Africa shortly after the landing of Van Riebeeck, the object being to make brandy, a commodity in which the Netherlands East India Company traded with the East. The Dutch, however, were not expert viticulturalists, and the industry did not flourish until the arrival of the Huguenots, about the end of the 17th century. Many of the cool, heavily-thatched wine-cellars that form a familiar landscape feature in south-western districts to-day, date back to this period.

The long roots of the vine render the plant well-suited to the climatic conditions of the Mediterranean region of the Cape.

Paarl, *Worcester* and *Stellenbosch* are the chief centres, although there is no part of the winter-rain region where the vine is not cultivated. To the east of *Oudtshoorn*, however, the vine is seldom seen, except in private gardens and in irrigated areas such as Graaff-Reinet.

At the present time viticulture is one of the safest branches of farming in South Africa ; it is carried on in a region where climatic conditions are uniformly favourable from year to year and where hail is scarcely known. Moreover, the product is marketable in a variety of ways : in the form of wine, table-grapes, raisins, or brandy.

South African wines are not equal to the best French wines, but are probably not inferior to the Mediterranean product. The choicest wines, it will be noted, are derived from parts of Western Europe nearer to the North Sea, where cool winters assist maturing, than to the Mediterranean.

Tobacco. The tobacco plant is cultivated throughout the Union, particularly in the Transvaal and in the Cape Province. Broadly speaking, Transvaal tobacco is of the Virginia type, requiring summer rains, whilst the variety grown in the South-Western region of the Cape is Turkish tobacco, which prefers a winter rainfall. This region is second only to the Near East in the production of Turkish tobacco. Virginian tobacco is also grown in the Oudtshoorn, Swellendam and George districts. Natal produces a more tropical kind of tobacco, used in the making of cigars and cheroots of somewhat inferior quality.

Tobacco is sensitive to frost, and cannot therefore be cultivated in those parts of the High Veld where the spring rains are apt to arrive late, or where night frosts occur. A total annual rainfall of 25 or 30 inches is desirable, although in drier areas, e.g., the Little Karroo, irrigation may be employed.

In order that the leaf should be aromatic and full-flavoured, the soil should be rich not only in humus, but in potash and lime. Tobacco is subject to a widespread disease called wild-fire, which from time to time reduces the crop considerably. In some areas the industry is hampered through insufficiency of labour ; the work of picking, sorting, and threading the leaves requires many hands, and must be concentrated into as short a time as possible. The modern method of drying the leaf by means of heated air is not commonly practised in South Africa ; the usual procedure is to store the leaf in barns or expose it to the sun. Damaged tobacco, factory-waste, and stems are manufactured into native snuff, sheep-dip, and insecticide.

The annual production is about 10 million lb., *i.e.*, one-hundredth part of the United States crop. More scientific methods of cultivation, grading and curing would increase the value of the South African output considerably.

South African exports of tobacco are still negligible, and make little headway in the European market against the superior American leaf. The industry suffers from an over-production of low quality tobacco.

Tea. The cultivation of tea is restricted mainly to a relatively small region, about 3000 acres in area, near the mouth of the Tugela River in Natal. *Stanger* and *Kearsney* are the chief centres. The industry replaced the cultivation of the coffee plant, which about 50 years ago, both in Ceylon and Natal, was attacked by disease. After a long period of experimentation the first tea-crop was obtained in 1880, from Assam seed.

The tea-plant thrives in tropical and sub-tropical regions with a summer rainfall. The soil must be well-drained, and in Asia tea-plantations are usually situated on hill slopes. In Natal, however, where heavy rain-storms deluge the coast region from time to time, carrying away the soil from slopes of too steep a gradient, flat or gently-undulating land has to be used and artificial drainage resorted to.

The plantations are sheltered by eucalyptus trees, orange trees, or cedars from the strong winds that would otherwise harden the delicate leaves of the plants. The most favourable altitude is from 500 to 1000 feet above sea-level.

The tea-plant requires three or four years to grow, but from the time it begins to yield it may go on producing for half a century. Plucking continues throughout the whole year, except from July to September ; hence there is no danger of the entire harvest being ruined by a hail-storm, as may happen with other crops.

Tea cultivation demands all the patience and skill upon which successful gardening depends. For this reason the labour of Asiatics has been utilized rather than that of the South African native, and with the restrictions placed upon Indian immigration, the industry has steadily declined. Both the area under cultivation and the annual production are at present only one-half what they were during any of the years 1910-1918. Of the total amount of tea consumed annually in South Africa, less than 5% is home grown.

Cotton. The first experiments in cotton-growing in South Africa, made half a century ago, were a complete failure. During recent years, however, owing largely to the enterprise of the Empire Cotton Growing Corporation, the industry seems to have entered upon a more successful phase.

The market for raw cotton is expanding rapidly. At present nearly three-quarters of the total cotton-production of the world comes from the United States ; from which source, however, as from India, the amount of raw cotton available for export tends to diminish in proportion to the growth of cotton manufactures within the country. Moreover, poor American harvests have from time to time inflicted great hardships upon large industrial populations in Europe by depriving them of raw material.

Cotton-growing is one of the most highly-specialized branches of agriculture, and in South Africa the industry has scarcely passed the experimental stage ; and although large areas have been sown with cotton, the problem of evolving a kind of seed best suited to South African conditions is one still engaging the attention of experts. While American upland varieties seem to thrive well, attempts are being made to introduce the more valuable Egyptian long-staple cotton.

Cultivation must remain restricted to low-veld areas, since during growth the plant is sensitive to frost. The rainfall factor is not so important ; cotton is a good drought-resistant, the plant having a long root. Indeed, in some parts of the world cotton of the finest quality is grown entirely by irrigation.

Labour-supply is an important factor ; and in this respect South Africa is at no disadvantage. Further, since the labour of native women and children is well suited to the plantations, cotton cultivation upon a large scale would not interfere with the supply of labour in other branches of industry.

At present development is most seriously hampered by lack of transport, for the areas most suitable for cotton-growing are *Zululand*, *Swaziland*, the *Transkei*, and the *Barberton*, *Waterberg*, *Marico*, *Rustenburg*, and *Zoutpansberg* districts of the Transvaal. Most of these regions have scarcely any railways. The total area estimated to be suited to cotton is about 4 million acres, of which 2·75 million acres are in the Transvaal. At present there are less than 50,000 acres under cotton.

Although the industry is still in the infant stage, production increased from 566 bales (500 lb.) in 1918 to about 6000 bales in 1931. (The United States crop is about 15 million bales annually.) Production is equally divided

between Natal and the Transvaal. Several ginneries have already been established. The by-products of the ginning process are cotton-seed oil and seed-cake ; the latter is a useful stock-food.

Lucerne, Hay, Root-crops, etc. After maize and wheat, the most valuable agricultural product of South Africa is the potato, which is grown wherever the summers are sufficiently cool and moist. Although potatoes are exported to the value of £20,000 annually, mainly to Portuguese East Africa and Mauritius, the crop is grown chiefly for home-consumption.

Lucerne, maize, oats, beans, sunflowers, cow peas, ground-nuts, teff, kafir-corn and various grasses are also cultivated extensively to serve as green fodder for farm animals. Since practically the whole of South Africa has a dry season, in which natural pastures disappear, some farmers have learned the utility of growing compensating fodder-crops either during the wet season or by irrigation.

The most useful of these stock foods is lucerne. Ostrich-farming, pig-rearing and dairying owe much of their success to this invaluable product. Lucerne grows best in limestone districts ; *Oudtshoorn* and *Graaff-Reinet* are important centres. Its cultivation, however, is widespread ; most farmers grow the crop for their own requirements. The roots of the plant have been known to attain a length of 60 feet ; it is therefore a good drought-resistant, and grows well with moderate irrigation. Once sown, lucerne need not be resown for several years, and yields from five to seven cuttings annually.

All the fodder-crops enumerated above may be preserved for use in dry seasons in the form of ensilage. For this purpose crops are cut green and packed into bins or silos, often made of concrete, or even into long rectangular pits dug in the ground. The surface is weighted down by means of earth or flat stones, so as to exclude air and keep the silage in a succulent condition. If this means of preserving green fodder were more widely adopted, the losses of stock through drought would not be so severe as at present.

The Report of the Drought Investigation Commission suggests the extended cultivation of the spineless prickly-pear, the carob tree, the mesquite bean, and numerous other drought-resistant plants of value as stock food. It also recommends for consideration the possibility of establishing a Fodder Bank, which would accumulate forage in years of plenty and sell it to the stock-farmer in lean years.

Sugar. Cane-sugar is essentially a product of coast-lands and islands in tropical latitudes. In these regions heat and moisture are abundant, and the soil, often of volcanic origin, is rich in plant food. Sugar cultivation demands also a suitable population ; for while warmth and humidity render the life of the European planters sufficiently trying, the sustained labour of cutting the canes is so arduous that only the most docile and industrious natives will undertake it. In South Africa these conditions are only approximately fulfilled, and only within a limited area, viz., in the hot wet coast-lands extending northwards from the Umzimkulu River to St. Lucia Bay.

The output of this region, although not much greater than that from the tiny island of Mauritius, is more than sufficient to meet the South African demand. Moreover, at the present cost of production it would not seem desirable to increase the output ; for elsewhere sugar is produced more cheaply than in South Africa. Hence the problem confronting the industry is the problem of how sugar might be produced more cheaply, so that the industry could maintain itself in the event of the present duty (1932) of 16*s.* per 100 lb. on imported sugar being repealed.

This problem resolves itself into two factors : the maintenance of a suitable labour supply, and the difficulty of finding a better type of cane.

As far back as 1850 it became evident that South African natives do not like work on sugar plantations. A temporary remedy was found in permitting the immigration of Indian labour ; and although high wages had to be paid, the cost of living being greater than in India, a prosperous industry was built up on this Asiatic labour basis. During the last decade, however, the problem of a suitable labour-supply has again become a serious one. Many Indians have left the plantations in favour of shopkeeping ; others have taken advantage of the Government system of repatriation ; whilst in 1913 further Asiatic immigration was terminated by law. Thus the principal concern of sugar-growers at present is the steady draining-away of Indian labour, and the persistent unwillingness of the South African native, except at a relatively high wage, to endure the unremitting toil of the canefields.

The second factor in the problem is the difficulty of finding the most advantageous type of cane. Having experimented with canes from Mauritius, Cuba, Java, and other places, the early planters decided in favour of *uba* cane, an Indian variety possessing the great merit of immunity from *mosaic*, a disease to which most types of cane are subject. Uba, however, is a hard fibrous variety requiring more expensive crushing machinery than the softer canes. To-day 99·8% of the Natal cane-fields are planted with uba ; but sugar-growers are searching for a type of cane that will resist disease and at the same time yield sugar with less difficulty.

The sugar industry involves a high degree of organization, particularly in respect of transport. Since cane spoils rapidly unless crushed within a few hours of being cut, the plantations are intersected by tramways and light railways, so that the cane may be conveyed rapidly to the mills. Not every planter, however, can afford crushing machinery ; the equipment of a mill costs many thousands of pounds. Hence throughout Natal there are only 25 crushing mills. The by-products of the refining process are molasses, ether, motor fuel, methylated spirits, rum, and cane-wax (used in the making of polishes and gramophone records). The total area producing sugar is about 300,000 acres.

At present the sugar-beet is not grown in South Africa, except at the experimental farms of the Potchefstroom School of Agriculture, where it has been proved that beets grown in this country yield a high percentage of sugar. This crop, if grown widely, would prove of great value, not only for the sugar content but also for the high fodder-value of the residue.

CHAPTER VIII.

MINING.

The pioneers of South African settlement had immense obstacles to overcome. They had to wrest a livelihood from a land that was not very productive, and in which transport was exceptionally difficult. The existence of rare minerals being unknown, the early colonists were entirely dependent upon a small surplus of foodstuffs for the purchase of other necessaries.

With the discovery of gold and diamonds half a century ago, the whole outlook changed. The mining industry has attracted to the country an enormous amount of overseas capital. A network of railways has been constructed ; great ports have been created. Moreover, the mines have contributed in taxation a large amount of revenue with which agriculture and other industries have been assisted ; whilst in the neighbourhood of the big mining centres regions that would otherwise be poor pastoral areas have been intensively cultivated, frequently by the help of irrigation. There can be no doubt that had it not been for the discovery of minerals, South Africa would still be a primitive and undeveloped pastoral region.

On the other hand, if we contrast wealth taken from the mines with wealth created by farming, it will be evident that prosperity arising from the former is insecure and in time may disappear. Sooner or later mines are exhausted ; in some instances, indeed, they are abandoned before exhaustion is reached, owing to the increased cost of working at a greater depth. Already we see, in the abandoned workings of Namaqualand and of the West Rand, the beginnings of the gradual extinction of our mining industry.

Another fact to be considered is that at present the greater part of our mineral output consists of gold and diamonds, whereas the United States, Great Britain and the industrial areas of Europe produce an abundance of minerals like coal and iron, which form the basis of manufacturing industries. The difference between such manufacturing industries and the mining industry of South Africa is that the former tend to persist even when local raw material is exhausted.

The following table shows the mineral production of the Union :

	Value of Production (average 1929-30).
Chief Minerals.	
(1) Gold*	£46,000,000
(2) Diamonds	£6,000,000
(3) Coal	£3,000,000
Other Minerals.	
Copper	£600,000
Asbestos	£400,000
Platinum	£275,000
Tin	£180,000
Silver	£100,000
Quarry Products	£95,000
Osmiridium	£80,000
Manganese	£45,000

In addition to the above, iron, corundum, graphite, mica, talc, chromium, lead and other minerals are obtained in varying quantities.

Gold. If the rocks composing any portion of the earth's crust contain gold, the first indications of the metal usually occur in the neighbourhood of streams, or in the water-courses themselves, where gold dust and small nuggets may be obtained by washing away the sand or gravel. Gold found in this way has been transported by river action from the parent rock in which it was first formed, and is therefore called alluvial gold. The quantity of gold that may be gleaned in this capricious and uncertain manner from river-beds, however, is small. Accordingly, geologist and prospector trace the gold back to its source, and after patient search discover large beds of rock, sometimes near the surface but often at a great depth, containing the original store of gold particles. The extraction of gold from this parent-rock is a vast industry, and in South Africa is called reef-mining.

Although indications of gold had previously been noticed in many parts of South Africa, the first discoveries of real importance took place about the year 1873, when alluvial deposits were found in the *Lydenburg* district of the Transvaal. Gold nuggets of considerable size rewarded the early prospectors in this area. Twelve years later goldfields were opened in *Barberton*, where both alluvial and reef mining have been carried on.

The output from these districts, however, has become insignificant compared with that of the Witwatersrand, now recognized to be the world's richest gold-mining region. ' The Rand ' as it is usually called, is a lofty ridge to the north of the Vaal, extending for about 60 miles from west to east, and forming a watershed between the Vaal and Limpopo river-basins. Along this ridge thriving mining towns have grown up with phenomenal rapidity, the chief being *Johannesburg*, *Krugersdorp*, *Benoni*, *Springs*,

* The value of gold production increased enormously in 1932 owing to a rise in the price of gold.

Brakpan, *Germiston* and *Boksburg*. So great indeed has been the growth of population in this region that it is more accurate to think of these towns as constituting one vast urban district, with Johannesburg its main focus. Since 1916 the greatest development has occurred in the eastern part of the Witwatersrand.

The Witwatersrand is traversed by reefs, or veins, composed of quartz-conglomerate. This rock contains gold in fine particles. Over three tons of ore may have to be treated in order to recover one ounce of gold. Drill and

Photo.] [*S.A.R. Publicity Department.*

SURFACE WORKINGS AND DUMPS, JOHANNESBURG.

dynamite having done their work, thousands of feet beneath the surface, the auriferous rock is hoisted up the long shafts. At the surface it is broken into evenly-sized pieces, ground to gravel, and sent to the stamp-mills, where hammers, weighing as much as twenty tons, reduce the rock to a fine pulp. The separation of the gold from the rock-fragments now begins. The crushed pulp passes over gently-moving copper plates coated with mercury. This substance amalgamates with much of the gold, from which it is afterwards separated by heating. A further process completes the separation of that proportion of gold with which the mercury failed to combine: the residue of rock-pulp is made to flow into large vats containing potassium cyanide solution, which dissolves most of the gold still remaining in the pulp. The separation of the gold from the cyanide is effected by a simple chemical process.

The mines of the Transvaal produce more than one-half of the world's gold. The total South African output during the last

50 years exceeds £1,000,000,000. It is therefore of interest to notice several factors which have favoured the industry.

(*a*) Coal is found in close proximity to the gold ; in some cases both minerals are obtained from the same mines.

(*b*) Native labour is cheap and abundant.

(*c*) There is an adequate water supply, both for the needs of the large towns and for washing the crushed rock.

(*d*) The hardness of the rock permits excavations to a great depth, with a minimum use of timber-props.

(*e*) The increase of temperature with depth is unusually low. The normal increase all over the world is 1° for every 65 feet ; in the Transvaal the average increase is only 1° for 212 feet. This peculiarity makes deep workings possible ; our mines are among the deepest in the world.

Whilst we appreciate the prosperity that gold has conferred upon South Africa, it should be noted that the industry is not a source of unmingled good to those actively engaged in it ; for the atmosphere of the mines is so laden with fine rock-particles that a large number of the labourers develop miners' phthisis. The companies, however, compensate those who become afflicted, whilst ventilation and dust-settling methods have done much to mitigate the evil.

Diamonds. The Union produces more than four-fifths of the world's diamonds, the remainder occurring mainly in Brazil and in South-West Africa.

The first important discoveries, which took place between 1866 and 1870, were made on farms in the neighbourhood of the Vaal and Orange Rivers. Within fifteen years the railway had been extended from Worcester to the new mining city of *Kimberley*, whose development rivals in romance the story of the goldfields in the Yukon.

Diamonds occur in two different ways.

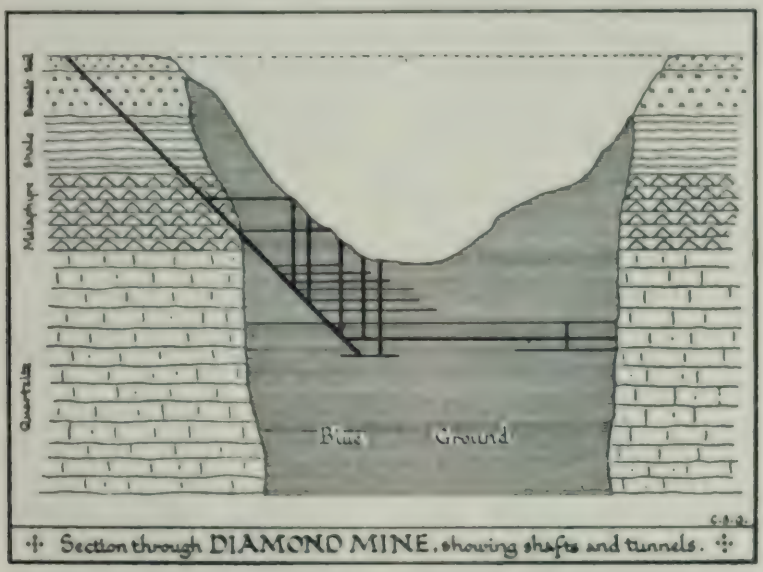
(1) Mine-stones are derived from a particular kind of igneous rock, which in certain areas has intruded into the upper rock-formations in the form of pipes or dykes. Diamonds are sought wherever such volcanic intrusions occur. Diamond-bearing rock is called kimberlite, or blueground ; it contains not only diamonds, but garnets, olivines, and other stones. All these gems have been formed by the heat and pressure associated with volcanic activity.

Diamond mines were at first open quarries. When a certain depth had been reached, however, dangerous falls of débris made underground workings necessary. Hence in mines rich enough to bear the expense shafts and tunnels are constructed, as in most other kinds of mining.

The hard blue ground is brought to the surface, crushed, mixed with water, and the lighter ingredients washed away. The diamonds are then separated from the sandy and muddy material

by washing over a succession of greased surfaces, to which the diamonds adhere, the waste material flowing away. The stones are then cleaned and sorted according to size, colour, shape and purity. Only a certain proportion of diamonds recovered from the blue ground have a high market value. Diamonds are now cut and polished at Cape Town, Kimberley and Johannesburg.

The bulk of the diamonds mined in South Africa come from *Kimberley*. Other diamond towns are *Jagersfontein*, *Koffiefontein*, *Kroonstad*, *Theunissen* and *Boshof*. Actually the largest single



Section through DIAMOND MINE, showing shafts and tunnels.

mine is the Premier Mine, 20 miles east of Pretoria. Here the volcanic pipe, oval in section, has an area of 8 acres. It was this mine that produced the Cullinan diamond, weighing 3024 carats (1¾ lb.), the largest white stone ever found in South Africa. The Union Government holds a six-tenths interest in the Premier Mine.

(2) Diamonds occur also as 'alluvial' stones, i.e., they are found in the beds of streams, whither they have been carried by various denuding agencies from the volcanic rock in which they were originally formed. The 'river-diggings' extend from the confluence of the Vaal and Orange Rivers as far as Klerksdorp, 350 miles to the north-east. The most important are those of Lichtenburg, Barkly West, Bloemhof, Christiana and Wolmaranstad. Recent discoveries have been made as far eastwards as Parys.

The proportion of alluvial diamonds to those obtained from mines has increased greatly in recent years. In 1920 only one-tenth of the total diamond output consisted of alluvial stones; in 1931 the ratio was one-third.

This development is largely the result of the discovery of extensive beds of diamondiferous gravel at Alexander Bay, a

Photo.] [*S.A.R. Publicity Department.*

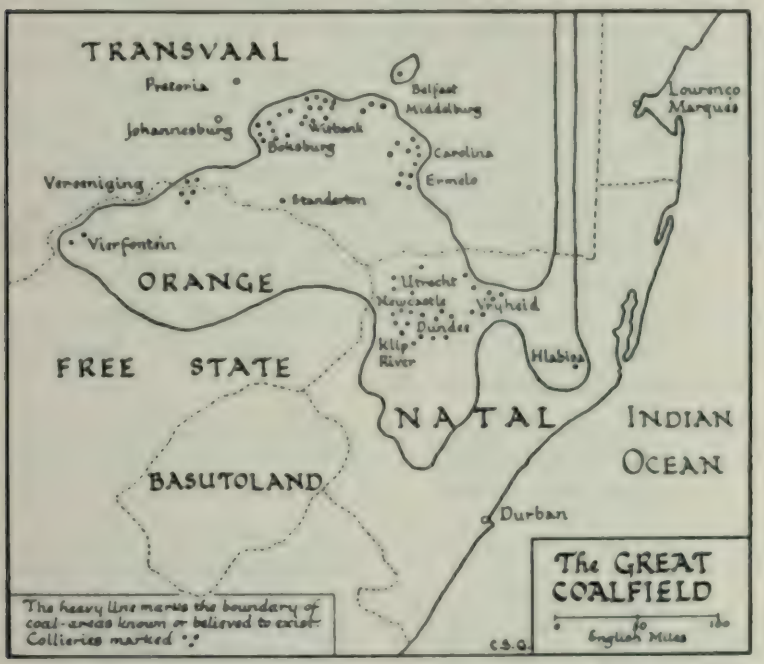
PREMIER DIAMOND MINE.

few miles to the south of the Orange River mouth. In 1927 the Government virtually took control of this area, so that the output of diamonds could be limited and the price maintained.

Alluvial diamonds are usually of a greater brilliance than those obtained from mines, and are worth much more per carat. The price of diamonds is determined altogether by their scarcity; and to maintain this price it is necessary to restrict the output in accordance with the demand. It may be inferred from the following statistics that the market for diamonds is a fluctuating one, and that those engaged in the industry cannot depend upon a uniform income.

Diamond Production in Millions Sterling.

1919.	1923.	1927.	1931.
35	6	12	4



Coal. While industrial and commercial progress is often the result of an abundance of coal, the existence of this mineral is not necessary to such progress, provided a country possesses the means or materials by which some other form of industrial power can be created. For example, although Sweden has scarcely any coal, iron-smelting is carried on by means of charcoal, whilst other industries make use of the natural abundance of water-power. It is therefore a fortunate circumstance that South Africa, situated at a great distance from countries having a surplus of coal for export, and lacking both water-power and extensive forests, should herself possess considerable coal resources.

Moreover, coal-mining in South Africa is encouraged by several favourable conditions. The mines are for the most part near the surface, they are singularly free from gas, and are therefore safe and economical to work. Labour, again, is so cheap and plentiful that pit-head prices are extremely low. There can be no doubt that the rapid expansion of our gold and diamond industries has been made possible only by the abundance of cheap coal.

South African coal is used principally by the mines, the railways, and in the making of electricity and gas, as well as by ships calling at our ports. There is also an export trade, notably with South America, Mauritius and India.

Although deposits are worked in places as far apart as the Limpopo valley and the Eastern Province of the Cape, the most important coalfields are those of the plateau region comprising the Southern Transvaal and the northern parts of Natal and the Orange Free State. The probable extent of these coal measures, and the areas already being worked, are shown in the sketch map.

More than half the output is contributed by the Transvaal; the largest collieries are those of *Witbank*, *Ermelo*, *Boksburg*, *Middelburg*, *Carolina*, *Belfast* and *Vereeniging*. Transvaal coal has excellent coking qualities, and is therefore suitable for smelting. The poorer varieties are used in the electric-power stations, of which the Transvaal has some of the largest in the world. The generating stations of the Victoria Falls and Transvaal Power Company, together with the hundreds of miles of overhead high-tension lines that transmit the current, are familiar features of the Witwatersrand landscape.

One-third of the total coal production comes from Natal, where the chief mining centres are *Newcastle*, *Klip River*, *Utrecht*, *Vryheid* and *Dundee*. Natal coal is of the kind useful for bunker purposes.

In the Orange Free State coal measures are worked south of the Vaal, between *Heilbron* and *Vereeniging*, and also further west, near *Vierfontein*. Outcrops of coal occur also in the hillsides around *Indwe* and *Molteno*, in the eastern part of the Cape Province, but these deposits are impure and have only a local importance.

Copper. Copper mining in Namaqualand, south of the Orange River, is said to date from the time of Simon van der Stel. Namaqualand, apart from copper, is an unproductive region; hence food, water and other necessaries have to be transported from the coast to the mining towns. The chief centres, *O'okiep*, *Nababeep*, and *Concordia* are connected with *Port Nolloth* by railway.

Although the copper resources of Namaqualand are by no means exhausted, copper can be produced elsewhere much more cheaply, with the result that at present these mines cannot be worked at a profit and have been temporarily closed.

Another source of copper is *Messina*, situated in the extreme north of the Transvaal. Mining operations in this region were at first handicapped by unhealthy climatic conditions. The region is within the tropics and has an altitude of only 2,000 feet. At present (1933) the entire South African copper output comes from this region.

PLATINUM. In South Africa the first platinum discovery of economic importance occurred as recently as 1923. Within two years discoveries had multiplied to such a degree that the Central and Eastern Transvaal came to be regarged as probably the most extensive platiniferous area in the world.

Experimental workings have been carried out in the *Waterberg*, *Middelburg*, *Carolina* and *Lydenburg* districts. In certain areas, however, it is doubtful whether the metal is present in quantities sufficient to justify mining operations.

Until recently platinum has been obtained mainly from the Ural Mountains, where the platinum fields are being gradually worked out, and from Colombia. The market price of the metal is about £20 per ounce ; that is to say, platinum costs three times as much as gold. This value is the result of usefulness, as well as rarity. Alloyed with iridium, platinum is the hardest of metals. It is useful in photography, and in the making of jewellery, magnetos, and scientific apparatus.

IRON. This important metal is mined near Pretoria, and in several parts of the great coalfield. Smelting works have been opened at *Pretoria*, *Vereeniging* and *Newcastle*.

TIN. The tin deposits of the Transvaal Bushveld must have attracted attention long before the days of recorded history, for ancient mine-workings are found in the *Rooiberg Hills*, to the north of Pretoria. Tin mining has been resumed in this area, and is also carried on in Natal, although at present the production is greatest in Swaziland, where heavy rainfall and the resulting denudation have exposed the ore.

SILVER. There are no silver mines of any consequence in the Union, although considerable quantities of the metal occur in association with both lead and gold. The largest output comes from the goldfields.

ASBESTOS. This is a blue fibrous substance, used as a fireproof and insulating material, derived from the beautiful mineral crocidolite. It is found throughout Griqualand West. The present depression in this industry is due to the competition of white asbestos of longer fibre, of which Rhodesia has an abundance. Recently, however, the white variety has also been found in the *Eastern Transvaal*.

OIL-SHALE. A noteworthy development may occur in the production of shale from which oil can be distilled. Oil-shale is known to exist in the neighbourhood of *Ermelo* and *Wakkerstroom* in the Transvaal, and near *Utrecht*, *Newcastle*, and *Impendhle* in Natal. Since the mineral is frequently found with coal, it is possible that distillation-plants may be erected at the collieries.

BUILDING STONE. In South Africa there is an abundance of clay for brickmaking, limestone for the making of cement, and sandstone, granite, and marble for building. In fact, the Union possesses rocks which are admirably suited to these purposes.

CHAPTER IX.

MANUFACTURING INDUSTRIES.

We have seen that the mainstay of the economic development of South Africa has hitherto been the production of minerals, raw material, and foodstuffs for home and foreign markets. This chapter is devoted to a discussion of the present position and the prospects of our manufacturing industries.

The justification for such industries is that they take raw material and by some process of manufacture enhance its usefulness and value. Wool, for example, may either be exported as raw material, or retained in the country which produced it, and transformed into cloth and blankets of greater value than the original wool.

The added value obviously increases the national wealth, whilst the industries themselves give employment to a large number of people. In 1929-30 raw material worth £56,000,000 was transformed into manufactured products valued at £112,000,000; the difference of £56,000,000 represents value added in the process of manufacture. This is equivalent to an average added value of £255 per person engaged in factory industries.

The value added to raw material by the transforming processes known as manufacture may be relatively small, as in the canning of crawfish, or relatively great, as in the textile and engineering trades.

Of course, a country may be prosperous without great manufacturing industries. In fact there are many who believe that the increased wealth derived from manufactures is offset by the depressing and unhealthy conditions associated with the factory system, and the loss of the freedom and spaciousness of the farmer's life. Nevertheless, it is not prudent to neglect manufactures entirely, especially in a country which at present depends for a great part of its prosperity upon mining industries that cannot be permanent.

For the sake of comparison let us study the industrial development of the sister-states of the British Commonwealth. If South Africa is backward in comparison with these other countries, we must search for causes.

COMPARISON BETWEEN SOUTH AFRICA AND OTHER COUNTRIES.

Heading.	*South Africa* 1929-30.	*Canada* 1928.	*New Zealand* 1929-30.	*Australia* 1929-30.
Population	7,000,000	8,500,000	1,250,000	5,500,000
Persons engaged in manufacture ...	219,000	661,000	86,000	419,000
Value of materials used	£56,000,000	£401,000,000	£59,000,000	£221,000,000
Value of manufactured product ...	£112,000,000	£775,000,000	£93,000,000	£391,000,000
Value added in manufacture ...	£56,000,000	£374,000,000	£34,000,000	£170,000,000
Value of production per person engaged in manufacture	£513	£1,172	£1,089	£933
Value added per person engaged in manufactures ...	£255	£565	£399	£373

Now, without a knowledge of all the factors and conditions involved, statistics are apt to be misleading. For example, it is evident from the last two rows of figures, reading horizontally, that both the value of the manufactured product, and the value added per person engaged in manufactures, is lower in South Africa than in any of the other countries. The inferiority, however, is not so great as it would seem ; for in South Africa the manufacturing population includes natives and coloured people whose output per person is lower than that of the Europeans employed in factories. Moreover, industrial expansion in South Africa is beset with certain difficulties not encountered to the same degree elsewhere. Let us therefore consider the general principles which affect manufacturing development, especially in South Africa.

1. CONSERVATISM. The opening up of new fields of enterprise is frequently hampered by a reluctance to alter existing conditions. For example, country store-keepers in the early days were financed by, and to that extent subject to, the great importing firms at the coast, whose profits depended upon the maintenance of a large import trade. The result of this arrangement was that the sale of imported articles was pressed forward, even when South African products were beginning to be available. Thus for a considerable period the Natal Government refused to utilize Natal coal on the railways of the province ; it was considered incredible that the quality should be good enough. This attitude is reminiscent of the Colonel in one of Lady Anne Barnard's letters, who used to declare that in South Africa " even the hens laid stale eggs."

Has this hostility to our manufactures disappeared ? To some extent, probably. But there is still room for more faith and pride in the country and its possibilities. Industrial expansion can never come without a national sentiment in favour of it. Much of the greatness of Britain and Germany, and also of younger countries like the United States, Canada, Australia, and New Zealand, is founded upon a patriotic belief in the resources of the land and the capacities of the people.

2. Localization of Industries. The choice of a suitable locality for certain industries is simple and obvious. Thus jam-making in the Hex River Valley, the sugar industry of Natal, and fish-canning in the Cape Peninsula are industries that almost of necessity belong to the regions where the materials of the industry are produced.

On the other hand, it may be necessary to transport the raw material to a district where coal and water are available, or where climatic conditions are favourable. One of the greatest manufacturing industries of the world, the cotton industry of Lancashire, is carried on in a region 4000 miles from its main source of raw material. Similarly the paper-making industry of South Africa is confined to areas possessing an abundant water-supply for use in the pulp-mills. Brewing and wool-washing are definitely localized for the same reason.

Sometimes the problem is complicated by the raw material's being derived from several sources. For example, there was much discussion respecting the relative merits of Pretoria and Newcastle, sources of iron and coal respectively, as centres for extensions of the steel industry.

Manufacturing industries are usually carried on most profitably near the coast. For this reason it is possible that our industrial centre of gravity, which lies at present over the Vereeniging-Witwatersrand-Witbank district, may possibly shift eastwards into Natal. What advantages do coast areas possess over inland centres ?

(*a*) If bulky raw material has to be imported, transport from the coast adds to the cost of production.

(*b*) Since in South Africa the home market is small, certain industries can only succeed if the export trade is considerable. To this end, situation on the coast is advantageous.

(*c*) The coloured population, more suited to manufacturing industries than the native population, is concentrated mainly in the ports.

It will be apparent, however, that industrial expansion round our coasts is hampered by at least two disadvantages : (1) The distance of some of the coalfields from the coast. (2) The poverty of the coastline itself. Some countries possess excellent natural harbours and navigable inland waterways, with numerous tidal estuaries providing safe anchorage for fleets of merchant vessels. If South Africa had these natural assets, there would be a much larger field for manufacturing enterprise.

3. Transport. A considerable factor in the price of an article may be cost of transport, both of the finished product and of the raw material of which it was made. In South Africa these costs are exceptionally heavy.

(*a*) The relief of the country renders railway construction expensive, whilst for this and other reasons running costs are high.

(*b*) The competition of sea-borne coastwise traffic, and of water-borne inland traffic, does not play the same part in reducing railway rates as it does in many other countries.

(*c*) The distances separating the factories from sources of raw mateiral and from markets are greater than in most manufacturing countries. This fact is attested by our scattered population, whose density is 15 per square mile compared with 482 in the United Kingdom and 665 in Belgium.

Whatever good reasons there may be for high railway rates, however, it is certainly true that in many instances goods manufactured in inland towns are more expensive at the coast, owing to high transport costs, than similar articles imported from overseas. Pig-iron, for example, is produced in Pretoria at £3 per ton, but railage to Bloemfontein brings up the price to about £5 per ton. Suppose, again, a merchant in Durban wishes to choose between machine-parts made in Europe and similar articles manufactured in Maritzburg. The railage from Maritzburg for the South African product is greater than the sea-freight from Europe to South Africa.

4. Industrial Power. (*a*) *Coal.* Although not inexpensive in some parts of the country, owing to transport costs, pithead prices of coal are lower in South Africa than elsewhere, except perhaps in some parts of the East.

An important feature of our coal is that, although sometimes of low grade, it can be utilized in the production of electricity. The Witwatersrand has one of the largest electrical power stations in the world.

(*b*) *Hydro-electric power.* Hydro-electric power is now an extremely important factor in well-watered, mountainous countries like Switzerland, Japan and Sweden; it has transformed the Plain of Lombardy, a region devoid of coal, into a manufacturing area of the first importance.

It should be understood that water directed through the turbines is not wasted: it is still available, if required, for irrigation. It is also wrong to suppose that power stations must of necessity diminish the attractiveness of river-scenery.

Apart from the Victoria Falls, however, South Africa is not well-favoured with regard to hydro-electric possibilities. The chief reason is the reduced flow of the rivers during the dry months. For example, in February, after the rainy season, the flow of the Tugela River at Colenso is 89,000 cubic feet per second; in September, at the end of the dry season, the flow is reduced to 29 cubic feet per second. Nevertheless, power from the magnificent Umgeni Falls at *Howick* is utilized locally in the manufacture of rubber and other products.

The Orange and Vaal rivers have their source in regions of heavy rainfall, but between the Basutoland boundary and Prieska the fall in level is insufficient to provide the head of water necessary for hydro-electric purposes. The *Aughrabies Falls*, near Upington, offer most promise. It is estimated that these falls, among the highest in the world over which a large volume of water passes, could generate 90,000 horse-power. That, however, is not a high figure. The water-turbines of Canada already produce more than 30 times that amount.

(*c*) *Oil.* This term denotes various substances derived usually from natural petroleum, *e.g.* motor-spirit, paraffin, naphtha, and lubricating oil.

The world's supplies of natural petroleum are limited; in South Africa it is not believed to exist in payable quantities at all. The artificial production of oil and spirit from various substances is therefore a problem of some urgency and importance.

Raw materials that can be utilized for the distillation of oil fall into two groups: (1) vegetable matter, *e.g.*, maize, prickly pear, potatoes, molasses; (2) carbonaceous rocks.

The latter, which include oil-shale and coal, constitute the more important source. Much coal not worked at present in South Africa owing to its poor steam-raising qualities has a high oil-content; whilst from the Transvaal oil-shales an average yield of 30 gallons to the ton is obtained. It would be premature, however, to venture an opinion as to the commercial possibilities of this form of industrial power in South Africa.

5. Markets. In any discussion of industrial expansion it would be difficult to exaggerate the importance of the economies that can be effected by large-scale production. Some industries are uneconomical except on a large scale.

It will be evident that the home market for South African products is frequently so limited that full advantage cannot be taken of these economies. Indeed, this difficulty is probably the manufacturer's chief handicap in competing with foreign producers.

The remedy is to find markets elsewhere. As population increases in Rhodesia, South-West Africa, the Belgian Congo, and British East Africa, our trade with those countries, owing to our favourable geographical position, should increase considerably. Possibly a Customs Union for the whole

of Southern Africa may at some time be established, although at present this appears to be unlikely.

Other possible markets are the republics of South America, whose industrial development, owing to deficiencies of coal and iron, may not proceed very far.

6. Labour. The expansion of manufacturing industries is conditioned, finally, by the presence of a population with the necessary predilection and aptitude for the conditions of industrial life. The early settlers, by tradition, were not of this type. Even to-day a large section of the Dutch population is more favourably disposed to farming pursuits. Among those of British descent, on the other hand, an undue proportion are engaged in commerce, and too few in production. The economic life of South Africa is very largely Dutch husbandry and English shopkeeping. The development of factory industries would therefore seem to demand increased immigration on the part of skilled artisans.

Again, every phase of the economic and political life of South Africa is complicated by the preponderance of the native races. Manufacturing industries are affected in several ways.

Although native labour is cheap and abundant it is unsuited, generally speaking, to highly-skilled factory processes: the native belongs more to the soil than to the workshop. Moreover, from the point of view of world-competition, labour in India and Japan is quite as cheap as in South Africa, with the difference that it is relatively efficient. The most hopeful aspect of the native problem, from the manufacturing point of view, is that the presence of a large native population is providing an expanding home market for blankets, clothing and household necessaries.

Progress and Present Position of Manufacturing Industries.

The actual story of South African industrial development is briefly told. Prior to 1902 some flour-mills, wool-washeries, a powder-factory and several breweries contributed the total manufactured output.

The last thirty years, however, have seen a substantial advance, which may be attributed principally to the impetus afforded by the Great War and to the expanding home market. Another factor, the importance of which might easily be underrated, is the encouragement given to every branch of industry by the activities of various Government departments.

The rapid progress which characterized the War period has not everywhere been maintained. Industries that showed promise of vigorous development in 1918 are clamouring for protection now that overseas competition has reasserted itself. Expert opinion is divided, of course, on the question whether 'infant industries' should be fostered by customs duties levied against imports; the subject is too controversial to be considered here. While it is true that both in Canada and Australia new industries have grown up under a system of tariffs, some authorities affirm that the policy is economically unsound.

The student should now address himself to a study of the industrial position. As already stated, the output of manufactured

DIFFERENT CLASSES OF MANUFACTURES AS PERCENTAGES OF TOTAL FACTORY PRODUCTION, 1929–30.

Product or Industry.

Preparation and preserving of food and drink : 30%

Engineering and Metal-working : 20%

Building : 9%

Heat, light and power : 7%

Drugs, chemicals and fertilizers : 7%

Printing and book-production : 5%

Clothing and textiles : 5%

Vehicles : 4%

Leather and leather goods : 3%

Bricks, stone, cement, lime, etc. : 3%

Miscellaneous : 7%

goods for the year 1929-30 reached a total of 112 millions sterling. An analysis of the chief industries appears on page 131 ; their relative importance is indicated by percentages of the total factory output, and also by rectangles drawn to scale.

Certain features of these industries call for special comment :

(a) The two largest groups together constitute half the total, whilst the preparation of food and drink alone constitutes nearly one-third of the total.

(b) Comparing this list of industries with the table of exports on page 142, it will appear that our manufactured products are only to a small extent exported ; i.e., we manufacture mainly for the home-market. Thus South Africa has no industries comparable with those of the Clyde basin or the Ruhr district, which command a world-market.

Distribution. Four great industrial districts, the Witwatersrand, the S.W. Cape, Durban and Port Elizabeth, together contribute 73% of the total output. Their comparative development for the year 1929-30 is shown below.

District.	*Value of Manufactured Produce.*	*Number of Factories.*
Southern Transvaal ...	£36,000,000 ...	1,952
S.W. Cape	£24,000,000 ...	1,321
Durban	£15,000,000 ...	586
Port Elizabeth ...	£7,000,000 ...	222
Totals for Union ...	£112,000,000 ...	7,730

Manufacturing industries in the most important of these areas owe their existence, directly or indirectly, to mineral wealth. It is only to be expected that the enormous requirements of a large mining industry should evoke local manufacturing enterprise, especially in view of the remoteness of the industry from other sources of supply. The Witwatersrand therefore itself produces as far as possible, the varied equipment of winding gear and crushing machinery utilized in gold-mining. Such manufacturing industries are developing all the more rapidly owing to the abundance and accessibility of coal and iron.

It is noteworthy that the three remaining industrial regions are situated near the coast. Certain reasons for such localization have already been given. It will also be apparent that whereas the Witwatersrand is primarily an engineering and metal-working centre, the coast districts specialize in the preparation and manufacture of foodstuffs, clothing and leather goods, the raw material of which is either imported or produced in the well-watered hinterlands.

NOTES ON SPECIAL INDUSTRIES.

(1) *The manufacture of foodstuffs.* It is paradoxical that a farming country should import such large quantities of canned and preserved foodstuffs. There has been, however, a notable development of the dairying, preserved fruit, and sugar industries.

(2) *Engineering and metal-working industries.* The most noteworthy development in this group of industries has been in regard to iron and steel, the production of which has been encouraged during recent years by means of bounties. To promote still further the development of these industries, the South African Iron and Steel Corporation was founded in 1928. Steel production will have the advantage of cheap coal and of supremely good iron-ore, but owing to the cost of skilled labour and the smallness of the home market the price of steel is likely to be high. Secondary industries are expanding rapidly, especially the making of mining equipment, railway plant, and rolling stock. The requirements of the agricultural industry should further stimulate production in this group.

The rapid multiplication of electrical undertakings throughout the Union suggests also the possibility of the refinement and manufacture of copper, which enters very largely into electrical equipment.

(3) *Chemical industries.* Included under this comprehensive term is the manufacture of medicines, explosives, candles, soap, matches, insecticides, paints, fertilizers, varnishes, wattle-bark extract and many other articles.

In a majority of instances the raw material for these industries is imported. For example certain fertilizers, manufactured in large quantities at *Somerset West*, are made from phosphate rock imported from Christmas Island, near Java. The same factory produces blasting compounds, for export as well as for the home market. Explosives, fertilizers and sheep-dip are made also at *Modderfontein*, and at *Umbogintwini*, near Durban.

There are five factories in Natal where wattle-extract is now made. The production of this article will serve as a stimulus to the leather industries.

The chemical industry could be extended by the utilization of by-products. The process of converting coal into coke, for the manufacture of steel, yields as by-products fertilizers and dyes. Again, industrial alcohol may be derived from the waste-products of sugar-refineries. Wool-washing also produces by-products in the form of lanoline and other fats, which might be utilized in the dressing of leather and in the making of soap and candles.

(4) *Clothing and textile industries.* Tailoring and dressmaking establishments and clothing factories contribute the greater part of the output ; tarpaulins, tents and rope also appear prominently in this group.

Real textile industries are relatively undeveloped. There are woollen mills at *Wolseley*, *Cape Town*, and *Harrismith*, where blankets and woollen fabrics are made ; there is also an admirably-organized home spinning and weaving industry at *Philippolis* (O.F.S.) producing lace, homespun cloth, tapestry, carpets, and travelling rugs. Blankets and rugs are exported, chiefly to Portuguese East Africa.

(5) *Leather and bootmaking industries.* These comprise the tanning and dressing of leather, and the making of boots, shoes, harness, saddlery, etc.

Since South Africa produces hides, and also most of the chemicals, including wattle extract, used in tanning, a considerable expansion of the leather industry may be anticipated.

There is scope for the production of better-class boots and shoes. The output of boots and shoes for 1930 was about 3,600,000 pairs. Port Elizabeth is the chief centre of the industry.

(6) *The ceramic industry.* Since it depends for its raw material upon some kind of clay, which is usually worked not far from the locality which produces it, the ceramic industry is widespread. Ceramic products include

bricks, tiles, drain-pipes, household crockery, chimney pots, architectural stoneware, porcelain, electrical fittings, and such articles.

Clay is a large component of many of the sedimentary rocks that occur in South Africa. Common red or yellow clays, *e.g.*, those used in brickmaking, are therefore of general occurrence. Kaolin or china-clay, on the other hand, which is usually a decomposition product of felspar, is comparatively rare. It may follow, therefore, that in its finer and more artistic branches the ceramic industry has limited possibilities.

(7) *Various industries.* There are ten wool-washeries at present in operation. Some have closed down in recent years ; many European manufacturers prefer to buy greasy wool and treat it from the beginning according to their special requirements. Wool-washing is not an especially profitable industry, since it involves the use both of elaborate machinery and of imported scouring materials.

The miscellaneous group includes timber manufactured in saw-mills, carpenters' shops and in the railway workshops (£2,700,000), furniture (£2,400,000), instruments and jewellery (£1,600,000), and shipbuilding (£63,000).

CHAPTER X.

LABOUR RESOURCES.

One of the greatest sources of wealth a country can possess is an efficient, plentiful, and cheap labour supply. The Union has none of these economic advantages. The labour supply is recruited chiefly from the native and coloured population, and it is therefore often assumed that in this country labour is cheap; but, though the average wages are low, it must be realized that there is a very poor average of efficiency.

In the Native Territories there is an abundant labour supply. In fact, there is nearly always a surplus available for use elsewhere. The native, however, prefers leisure to wealth, and is not therefore anxious to leave the kraal; but taxation, drought, an increasing desire to possess luxuries, and the desire to purchase cattle and wives, impel him to leave the territories in order to earn money elsewhere.

It is in our largest industries, pasturing and agriculture, that there is the greatest demand for labour. These industries give employment to over 150,000 adult European males, and three times as many non-Europeans. The latter comprise paid labourers who live on the farms, squatters, and labourers who come daily or seasonally, from locations and from the Native Territories. Generally there is a sufficiency of farm labourers, except in certain areas at harvest time and for fruit-packing. The Maize Area frequently has an insufficient supply, especially as the natives are attracted by the higher wages offered by the mines. During the sugar-cane cutting season there is a shortage, and in the S.W. Cape there is a general deficiency, as fruit-picking demands a higher standard of labour than most farm work, and native or coloured labour is not as a rule of a high standard. These deficiencies in the maize area, in Natal and the S.W. Cape, probably do not exceed 15,000 annually. In most urban areas there is an excess of unskilled non-European labourers.

By custom the native is a pastoralist, not an agriculturist. Women are the tillers. The men are hunters and dislike the hoe, though the ox-drawn plough appeals to them, as women must have nothing to do with cattle. Very frequently, therefore, the native labourer is inefficient.

Another reason for the low standard of native agricultural labour is the prevalence of the squatting system. Although the conditions for such squatting rights vary, it is usual for the younger male members of the family to supply labour to the farmer, and for the women to perform household tasks. In return, the head of the kraal receives land on which to build his huts and sow his grain and from which to obtain water and grazing for his animals. In Natal and parts of the Transvaal the headman receives these privileges in return for six months' labour ; in other parts of the Transvaal and in the Orange Free State only ninety days' labour is required. Sometimes the squatters work all the year round for a small wage and the payment of poll tax. In some areas the six months' or ninety days' labour is required at a stretch, in others at different times. It is an advantage if the work is done at a stretch, as surplus labour can then move outwards and earn money elsewhere. If the farmer demands labour whenever he pleases, the native is bound to the soil.

This system is not without advantages to the squatters. They have security and a fairly certain, if low, standard of living ; a standard at any rate to which they are accustomed. Above all, they have considerable leisure, and an abundant variety of amusements with which to pass this leisure time, *e.g.*, beer-drinks, initiation ceremonies, debates, neighbourly visits and endless talk. And he who has many children and marriageable daughters can have perennial leisure.

This, unfortunately, does not improve the economic standard of living for the country as a whole, and agriculture suffers. There can be no doubt, however, that when more intensive agriculture is practised, the easy-going poverty-stricken squatter will give place to the paid labourer who works all the year round.

Since the European demands a relatively high wage, he is rarely employed as a labourer. If the European of insufficient resources fails to farm his own land profitably, he all too often becomes a " poor white." The native, however, is the vital factor in agriculture, and he rarely works all the year round. Agriculture, therefore, suffers from an uneven and somewhat ignorant labour supply. Mining demands, after farming, the next largest supply of labour. Peculiarly, the supply of labour available for mining depends upon climate. In other words, it depends largely upon the condition of agriculture, during each season, or the preceding one. If drought occurs, the natives, particularly in the Territories and Protectorates, feel the pinch of poverty, and in order to pay taxes and buy necessities, have to earn money instead of selling their own produce. Consequently, in seasons of drought there is no labour shortage, but if farming is profitable then a scarcity occurs.

The native rarely leaves the kraal permanently. Indeed, he endeavours to be away for as short a time as possible—in fact, only long enough to earn sufficient money to pay taxes, buy cattle for ' lobola,' and procure necessities and a few luxuries. Then he hurries back to his kraal and his leisure. The poorer the harvest, the heavier the taxation ; and the more modern the chief, the more often do the natives leave home for the mines.

No encouragement is given by local authorities to recruiting agents in districts where natives are needed on the land, and those agents who in particular persuade natives to work on the gold mines generally go to those areas where natives are densely settled. The Zulu and Bechuana object to working underground, but recruits from Mozambique as well as from the Native Territories are drafted to the compounds on the Rand and elsewhere. The total number of non-European mine labourers exceeds 310,000 in normal times, but at least another 10,000 could be absorbed. The gold mines have machinery and a mining system which can only be worked economically if a certain number of natives are regularly employed. If there is a shortage or a variable supply, serious losses result. Few of the other mining centres suffer from a serious shortage of labour.

The number of Europeans working on the Rand gold mines is about 23,000. Most of them hold positions of responsibility and do not compete with the unskilled workers. There is no scarcity of skilled labour. Incidentally, the wages earned per head by Europeans is higher than elsewhere in the world. Yet the gold content per ton is less than in any other important gold field. In 1929 each worker on an average produced only 47 ounces of gold ; in Canada the output per man was 224 ounces. It is thus open to doubt whether the gold industry in South Africa could exist without an abundance of cheap native labour.

The production of other minerals also is cheapened by our plentiful labour supply. Coal, in particular, is produced very cheaply ; its pit-head cost is less than 5*s*. 6*d*. per ton. Over 30,000 natives work on the coal mines ; they outnumber the Europeans by twenty to one.

There is no shortage of labour in trade, commerce and industry ; usually there is an excess. These occupations depend, though, to a lesser degree than agriculture and mining, upon male native and coloured labour. In times of drought or depression natives leave the kraals and flock to the towns in relatively greater numbers than to the mines, because it is easier to earn ' quick money ' in towns.

For public services (roads, harbours, etc.) there is plentiful labour, and for skilled work (clerical, professional, etc.) there is a surplus. The unskilled work appeals to non-Europeans, as the wages are attractive and the work not especially unpleasant.

Unfortunately most servants are male natives, except in the S.W. Cape, where coloured females are common. As house-boys, natives are fairly efficient, but the work is not entirely suited to them and they could be employed more profitably elsewhere. It is still difficult to get female natives either to leave the kraals, or, having left them, to do satisfactory household work. House-boys earn excellent wages and have a comparatively easy life. So there is much competition amongst natives for such positions, even though it is ' unclean ' for most natives to do menial tasks. Until the female native works regularly in the towns the native boy will not be freed to do work which, if not so pleasant, is infinitely more useful to the community.

CHAPTER XI.

COMMUNICATIONS.

Communications are the nerves of settled countries. Good communications cheapen production, exports and imports, and play a large part in social life. Safe ocean travel, long navigable rivers, easy access by good harbours to coastal districts, good roads with smooth gradients, fast cheaply-running railways and an efficient air service, are to-day the very handmaids of a country's commerce. It is the misfortune of South Africa that nature has done little to make communication easy between inland town and inland town, between inland town and coastal port, or between South Africa and the outside world.

The ports are few and are subject to so many hazards that coastal traffic is discouraged ; movements between one port and another are unimportant. The rivers are practically useless as means of communication. South Africa has no St. Lawrence, no Rhine. The rivers, in fact, hinder rather than assist communication. Often they are whirling torrents of great depth and width, cut deeply into the plateau and scarpland ; in the dry season their beds are empty. They are always difficult to cross by rail and generally also by road. South Africa has no system of navigable canals. Not only would rivers, had they been like those of Europe, have been valuable in opening up the country and in affording easy access to the hinterlands, but also they would have cheapened immeasurably the productions of the country. Ocean and river or canal travel is the cheapest for all articles, but particularly for bulky goods. The absence of such aids is one of South Africa's misfortunes. Until the coming of the internal combustion engine, roads even in the large towns were poor, and travel, particularly on the plateau, was leisurely. The ox-wagon was the chief means of travel, but horses, mules and donkeys were used as well. Roads were rarely metalled. In wet weather they were often dangerous, especially where they crossed the frequently unbridged river. In dry weather they were dusty sometimes beyond endurance. The ox-wagon, drawn by 16 oxen, is still a frequent and picturesque sight, in harmony with the feeling of ' timelessness ' typical of the old Dutch life. 100 miles a week was a good average speed for the ox-wagon, though in rough country this speed was much reduced. The mule, donkey and horse-drawn wagon has a more variable speed. Horses, however, are apt to suffer from sickness in some areas.

Recently, particularly near the towns, good roads have been made joining the chief centres. As a rule they are very dusty, and away from the towns only cars with good springs and sufficient clearance can travel with safety and speed. From the early days of the nineteenth century, South African engineers have been faced with tremendous tasks in making good roads from the coast lands to the plateau. In bygone days to get from the plateau to the coast with a load of wool was a heart-rending task. Wheeled traffic was negligible. Even pack-horses found it a long and sometimes exciting journey.

Approaching the plateau the gradients are often very steep. Fortunately there are passes which permit, though at great cost, roads to be engineered and metalled. Using a large-scale map, the student should follow the roads from the chief coastal towns to the plateau. This is the best way to learn the essential structure of South Africa, and to understand the difficulties that structure imposes upon the making of roads and railways. The plateau was reached by 'poorts' or passes (e.g., Sir Lowry's Pass, Bain's Kloof), and thus the principal inland towns were joined to the coast. But the small amount of trade before the discovery of minerals, and the type of trade then in existence, did not justify the building of a network of good roads. Even to-day, off the main routes, roads are frequently 'ruts in the veld' below the level of the surrounding land. The roads, or their absence, both justify and explain the ox-wagon. To-day road travel will increase, apart from the greater private use of motor cars, because of the 'Railway' policy of building fewer branch lines to small centres away from the existing lines, and of using motor traction in the place of railways.

A study of the South African railway system reveals several striking facts. (1) There are few railways west of the 20″ isohyet; most of the lines that do exist connect the richer north and east to the south. (2) The ports, Cape Town, Mossel Bay, Port Elizabeth, East London, Durban, and Lourenço Marques, are obvious termini of lines from the north. (3) There is no central nodal railway site, common to European and North American countries, from which railways radiate. In this respect South Africa is similar to Australia, though the latter country has no 'Rand.' (4) Natal has the greatest proportion of railways to the square mile. (5) There is no continuous connecting line around the coast. (6) The railway frequently seems to end in a manner which must annoy the railway engineer and economist, for a considerable number of connecting links have still to be made: *e.g.*, Rustenburg-Zwartruggens, Lichtenburg-Mafeking, Winburg-Marquard-Ficksburg, Vryheid-St. Lucia, Avontuur-Uniondale Road, Calitzdorp-Ladismith. (7) The railways often gain the plateau by roundabout routes. (8) The huge triangle from Touws River to Klipplaat and then to De Aar has no railway within it, and this is an area near to the coast and settled early in South African history. (9) Basutoland, Swaziland, and most of Bechuanaland are without railways, whilst the native areas have only a small mileage. (10) Most of the railways avoid river valleys. (11) Railway development in South Africa has differed radically from that of other new countries in that railways have succeeded settlement; settlement has not waited upon railway construction.

It is unnecessary here to discuss the causes of railway development beyond saying that every port tried to get railways connecting it with the diamond and gold fields in the Cape and the Transvaal. They were built, therefore, as straight as possible (note straightness of railway from Baralong Farms to Francistown and the central trunk line through the Orange Free State), ignoring all but the larger settlements. As a rule construction on the plateau was easy.

Considering the poverty of the natives and the fewness of the Europeans, the mileage, in proportion to the population, is fairly high. The standard gauge is 3 feet 6 inches, although there are about 1,000 miles of line of only 2 feet gauge. The system is mainly Government-owned. There are nearly 14,000 miles of line, i.e., nearly 17 miles to each thousand square miles and just over seven miles to every thousand Europeans. (These figures include S.W. Africa.) The following table shows the relationship between mileage, area and population in the four provinces :

Province.	*Mileage.*	*Mileage per* 1000 *Square Miles.*	*Mileage per* 1000 *Persons (all races).*
Natal	1,500	45	1 (nearly)
Orange Free State ...	1,630	32	2·2
Transvaal	3,280	30	1·3
Cape Province ...	5,350	19	1·7
South-West Africa ...	1,540	5	6·7

The railways are conducted efficiently, but owing to physical and other causes the speeds of the trains are low. The fastest average runs are on the suburban electric lines ; the fastest main line run is that of the Union Limited from Cape Town to Johannesburg, the 956 miles being traversed in 29¾ hours at an average speed of 33¼ miles an hour.

Road motor services are becoming increasingly important ; in the Cape over 4,700 miles, in Natal over 1,200, in the Transvaal over 3,700, and in the Orange Free State over 1,200 miles of motor routes link the outlying districts with the railways.

CHAPTER XII.

COMMERCE AND PORTS.

The domestic or internal trade of the Union is concerned largely with foodstuffs and manufactured goods. Cattle and sheep are conveyed to the towns for slaughter. There is also a considerable movement of articles such as maize, sugar, wheat and fruit, whose production is more or less localized. Manufacturing industries, again, are centred very largely in the Southern Transvaal and the ports, so that the products of these industries have to be distributed throughout the country. In many parts of South Africa manufactured articles are expensive, owing to the vast distances such commodities have to be conveyed.

The external trade of the country is of great proportions considering that the European population is so small. The Union has what is called a 'favourable trade balance'; that is, our exports exceed our imports. This balance pays interest on foreign capital invested in the country, and charges made by shipping companies, insurance brokers, and other intermediaries. Owing to duties and transport costs, imported articles are often expensive.

Imports.* Rather more than eight million tons of goods are imported annually through the harbours, whilst about 400,000 tons enter the Union from the Rhodesias and South-West Africa. The total value of the imports is £76,000,000. Manufactured goods make up about three-quarters of the total, the chief items being machinery, metal goods and vehicles (£21·6 m.) and textiles and clothing (£18·9 m.). Foodstuffs (coffee, rice, tea, dairy produce, meal, wines and spirits, confectionery, fish, etc.), have an importance which is amazing considering that many of these articles can be produced in the country; their value is £7,800,800. Other imports include oils, paints, etc. (£4·7 m.), leather and rubber goods (£2·8 m.), timber and wood manufactures (£2·7 m.), drugs, chemicals and fertilisers (£2·7 m.), books, papers and stationery (£2·5 m.), jewellery, musical instruments and sports goods (£1·8 m.), and earthenware, glassware, etc. (£1 m.).

The average value of the exports is £88,700,000; it will be seen from the table below that minerals account for about two-thirds of the total.

* Figures represent averages for 1928, 1929 and 1930. The figures for 1931, an abnormal year, are disregarded.

Exports of South African Produce.

(Average 1928, 1929, 1930 £m.)

1.	*Minerals* (gold 44·8, diamonds 8·2, cargo and bunker coal 3·2)	£59	millions.
2.	*Pastoral and Agricultural Produce* (wool 13·3, hides and skins 3·2, maize 2·7, fruit 1·4, sugar 1·2)	£26	„
3.	*Miscellaneous* (whale-oil ·4, fish ·2) ...	£1·2	„
4.	*Exports to Rhodesias and South West Africa*	£2·5	„
		£88·7	„

In addition to gold, diamonds and coal, the Union exports copper, tin, asbestos, platinum, silver and other minerals. Meat, dairy-produce, wattle-bark and bark extract, cotton, eggs, mohair, tobacco and wines, belong to the second group. The miscellaneous group, besides whale-oil and fish, includes explosives, confectionery, furniture, chemicals, fertilizers, and leather goods. The average annual value of the Union's entrepôt (re-export) trade is £3·8 millions. This trade is in addition to the exports detailed above.

It is apparent from these particulars of exports that for a young country South Africa depends for her economic well-being upon assets which must of necessity decrease in value. To replace gold, agricultural and pastoral commodities must be produced in greater quantities, and marketed cheaply and efficiently.

In the following table our principal imports and exports are analysed with respect to the countries with which the Union carries on most of her trade:

Analysis of Foreign Trade. (av. 1928/29/30.)

(Principal commodities in brackets.)

Imports.	*Millions*	Exports.	*Millions*
United Kingdom (cotton and woollen goods, machinery and metal manufactures, railway and tramway material, electrical material, food, drink, etc.)	£30·9	*United Kingdom** (gold, wool, diamonds, fruit, sugar, maize, eggs, wattle extract, platinum, etc.)	£50·3
United States (motor vehicles, machinery, mineral oils, etc.)	£12·3	*France* (wool, hides and skins, fish, maize, etc.)	£4·2
Germany (railway material, machinery, electrical material, paper, etc.) ...	£4·5	*Germany* (wool, hides and skins, wattle bark, maize, etc.)	£4·1
S.W. Africa and the Rhodesias (live and slaughtered animals, dairy produce, gold, hides and skins, etc.) ...	£3·8	*Belgium* (diamonds, wool, etc.)	£3·3
India and Ceylon (bags, rice, tea, teak, etc.)	£3·1	*India and Ceylon* (gold, coal, etc.)	£3·2
		S.W. Africa and the Rhodesias (foodstuffs, vehicles, and miscellaneous manufactures)	£2·5

Canada (motor vehicles, paper, timber, farm implements, etc.)	£2·3
France (silk and woollen manufactures, haberdashery and millinery, etc.) ...	£1·5
Japan (silk and cotton manufactures, timber, fancy goods, etc.)	£1·4
Belgium (railway material, cotton goods, etc.) ...	£1·4
Holland (fertilizers, food and drink, etc.)	£1·3
Sweden (timber, paper, etc.)	£1·2
Dutch East Indies (mineral oils, tea, etc.)	£1·0
Holland (maize, diamonds, hides and skins, whale oil, etc.)	£1·4
United States (hides and skins, diamonds, wool, asbestos, etc.)	£1·4
Italy (wool, hides and skins, beef, etc.)	£1·2

*A part of these exports is re-exported by Britain to various European countries.

Coal. South Africa is fortunate in possessing cheap and abundant supplies of coal. If there were a greater demand for coal in the Indian Ocean or for bunkering, South Africa could easily supply it.

The average annual output is 13,450,000 tons (Transvaal 7,650,000 tons, Natal 4,700,000 tons, Orange Free State 1,100,000). The Cape and many of the coast districts are supplied by collieries which lie some distance away. Cape Town, for example, buys 400,000 tons annually, about two-thirds of which comes from Natal.

Our coal exports, *i.e.*, coal exported as cargo, go mainly to India, the Far East, and to East African and Red Sea ports. Antarctica, S. Georgia, Kerguelen and the South Shetlands take variable amounts according to the number of whalers and research ships in the Southern Ocean; *e.g.*, in 1927 3,000 tons, in 1931 75,000 tons. The bunkering trade is diminishing owing to the increasing number of oil-burning ships.

Nearly 80% of the cargo and bunker trade is carried on by Durban; Lourenço Marques is second with about 13%, and Cape Town third with 7%. The trade of the last-named is almost entirely in bunker-coal. No coal is exported from the remaining Union ports, whilst their trade in bunker-coal is practically negligible.

Ports. There are only three good natural harbours in the sub-continent, Walvis Bay, Saldanha Bay and Delagoa Bay. Of these the first and second have arid hinterlands, whilst the third is in Portuguese territory. False Bay has deep water at Simonstown, but is awkwardly situated and exposed to strong south-easters.

So essential has it been, however, for the Union to possess good harbours, that large sums have been spent in overcoming certain natural disadvantages. Thus large vessels may now be accommodated at Table Bay, Durban, Port Elizabeth, East London and Mossel Bay.

An interesting feature of these ports is that a larger percentage of their trade is concerned with the more remote hinterlands, and only a smaller percentage with the immediate hinterlands. Thus at least 80% of Cape Town's exports consist of gold, diamonds and maize, all derived from distant regions. The trade and hinterlands of the various ports will now be considered separately.

Cape Town overlooks a beautiful but dangerous bay of such depth that any vessel may anchor. It is exposed to north-west winds in winter, which often reach gale force, and in summer the south-easters blow strongly across the open Flats. Between March and June fogs, sometimes of 48 hours' duration, are common. A breakwater and harbour works have been constructed, and vessels of 36 feet draught can enter the Victoria Basin. Plentiful quayage, warehouse room and powerful tugs are available. Coaling wharves, pre-cooling chambers, oil-fuel tanks, a grain elevator and other facilities make the harbour adequate for all purposes. There are sufficient repairing shops, slipways, and graving and floating docks.

Cape Town is perhaps the only important 'nodal site' in the Union; more than any other port, she connects South Africa with the whole world. Thus she is a typical entrepôt—a distributing centre for passengers and commodities. Yet Cape Town suffers from the disability that apart from the fruitful winter rainfall area it possesses no rich hinterland until the arid Karroos are crossed. The effective hinterland of Cape Town is over 900 miles distant.

This disadvantage will be better realized from a comparison of actual distances. Kimberley is 162 miles nearer to Port Elizabeth than to Cape Town; Johannesburg is 563 miles nearer to Lourenço Marques than to Table Bay; whilst Durban and Port Elizabeth are nearer to the richest agricultural and pastoral areas. Even the coalfields are far distant from Table Bay.

Obviously therefore it is mainly goods of small bulk in proportion to their value that will be exported from the Transvaal and the Orange Free State *via* Cape Town; bulky commodities will leave the country by the nearer ports. Table Bay is favourably situated with regard to beef exports, for cattle can be slaughtered at the port, so that the beef is in the cooling chambers for a shorter time than if slaughtered at more distant ports. The development of the Benguella Railway, however, and the projected line from Walvis Bay to Rhodesia will result in less beef-export trade from Table Bay.

Mossel Bay is the natural outlet for the Little Karroo and the lowlands along the Breede River, and to a lesser degree for the Great Karroo. The relative poverty of these regions, however, together with the comparative nearness of Table Bay and Port Elizabeth, have discouraged expenditure on harbour improvements.

The bay is so shallow that only small vessels of 8 or 10 feet draught can lie alongside the two jetties; at the quay the depth is only 6 feet. Mail steamers and other large vessels discharge and load from lighters, of which the port has ten, with a total capacity of 820 tons. The harbour is fairly safe, and is free from currents, but owing to the wild south-easters ships sometimes cannot anchor. About 200 vessels, with a tonnage of 650,000 tons, enter the port annually. The principal exports are wool, citrus fruits, tobacco, skins, feathers, aloes and wattle bark; the total tonnage is only 12,000.

Port Elizabeth. This is the natural port for the Cape Midlands and part of the Karroos, and for most of the Orange Free State. The harbour has many disadvantages, and much money has been spent on improvements. It has always had a bad name amongst sailors, for the south-easters sometimes blow with the force of a full gale; in 1902 eighteen sailing vessels were blown ashore during a single storm.

The prevailing winds, however, are not from the south-east; more commonly they are easterly or off-shore winds. Large vessels can usually, therefore, lie at anchor in the bay. There is an inshore easterly current, but a mile or so from the coast the strong Mozambique current is encountered.

At the seaward end of the three jetties the depth of water is 24 feet, but close inshore it is much less. When the present harbour works are completed the largest ships sailing South African waters will be able to lie safely along the berths. There are 38 cargo lighters and 10 insulated lighters for the pre-cooling and storage of fruit. Tugs and repairing facilities are adequate, whilst dredgers clear away an immense amount of silt.

The chief imports are motor-car parts, railway material, timber, and general cargo; wool, fruit, mohair, hides and skins, eggs and feathers are exported.

East London. This port, although it carries on less trade than Algoa Bay, is favourably situated with respect to the Eastern Cape Province, including the native areas, and the southern part of the Orange Free State, all of which are moderately rich agriculturally and pastorally. For the importing of small and relatively valuable goods Port Elizabeth is used more than the Buffalo River, but for heavy commodities, where every extra mile of railage counts, East London has the advantage.

The harbour is unique in South Africa in that it makes use of a river mouth. In former days the bar across the estuary prevented entry; as a result of dredging only vessels of over 8000 tons lie outside at present. These large vessels will, however, enter when the new deep turning basin is completed. The open sea is somewhat dangerous, for gales are apt to occur at any time throughout the year. In such weather it is difficult to enter the river, and ships often have to steam out to sea, the inshore anchorage being dangerous.

General cargo, timber, grain, railway material, and oil are landed. Wool is the principal export; of less importance are citrus fruit, hides and skins, maize, eggs, wattle-bark and beef.

Durban. Durban has fairly easy communication with the rich Natal Province, and with the two inland provinces. Bulky goods move downhill from the plateau to the coast; those that move uphill have a high value even if they are bulky, so that the effect of the escarpment upon railway costs is modified. Thus Durban is the most favourably situated of all South African ports; it lies nearest to the most productive areas, whilst access to the harbour is comparatively easy. The mild climate and the natural beauties of the neighbourhood combine with these economic advantages to make it one of the principal centres in the Union.

The beautiful harbour has been dredged so that vessels drawing 35 feet can enter easily ; continuous excavation is necessary, however, to maintain this depth. There is ample berthage for large and small ships.

The prevailing winds are north-east and south-west. The latter, called the ' southerly buster,' usually comes ' with a bang ' about four o'clock on summer afternoons ; it may be accompanied by rain lasting from one to twelve hours. The easterly winds usually bring clear weather, although at times they reach gale force. A few miles from the shore the southerly currents are strong ; inshore there is often a counter-current. The seas are occasionally very heavy.

The harbour accommodation is excellent, and includes ample warehouse room, pre-cooling chambers, a grain elevator, and efficient coaling arrangements.

The exports, which amount to some 3,500,000 tons, are of great bulk in proportion to their value ; the principal items are coal, maize, wool, sugar, hides and skins, wattle bark and extract, citrus fruits, manganese ore, cotton, lucerne, eggs, meal and livestock.

Imports include machinery, clothing, textiles, oil, timber, railway material, and general cargo, the densely-populated Witwatersrand being the chief market. The average tonnage of goods landed is about 1,450,000. These imports, though of less weight than the exports, are of greater value.

As a passenger port Durban is second only to Cape Town, for about 45,000 land and embark annually. Like Cape Town, Durban provides vessels with enormous quantities of fresh water.

Port Nolloth used to be the port from which copper was exported to Swansea. It has an open roadstead, with fair anchorage, and a wharf for small coasters. There is much fog, and the prevailing south and west winds are strong. Much fish is caught along the coast. About 26,000 tons of cargo are dealt with annually, but the trade is declining.

False Bay (Simonstown and Kalk Bay) is sheltered from the north-west gales, but in summer the south-east winds often raise a heavy sea. The naval harbour is excellent. Merchant vessels anchor near the shore, and discharge, into lighters, some 12,000 tons of commodities, consisting mainly of coal and general cargo. The exports are negligible ; fish are caught locally, but there is no export.

Knysna imports some 2000 tons of general produce and exports small quantities of timber and furniture.

Saldanha Bay is a magnificent natural harbour with a waterless and unproductive hinterland. A world-fleet could lie comfortably at anchor—so spacious is the harbour. Formerly it was used by the East Indiamen, who careened their ships there ; to-day it is used only by whalers, sealers, and trawlers. The harbour is sheltered from the strong north-west winds.

Kosi Bay has been proposed as a port for the Southern Transvaal. The lagoon is somewhat protected by a bluff, but a great amount of dredging would be necessary. The region, however, is malarial, and it is doubtful whether it would be worth while to spend the large sum that would be required in order to duplicate the facilities at present enjoyed at Durban.

Lourenço Marques. This Portuguese port is the natural outlet for the Rand, to and from which access is easy. The intervening lowlands were once fever-stricken, but since the swamps were drained thirty years ago they are now healthy. Lourenço Marques is a health resort for the inland population, although in summer the heat and humidity are trying.

The dredged harbour offers a safe anchorage in all weathers, gales are rare, and fogs are seldom experienced. There are tugs, lighters, coaling-tips, pre-cooling chambers, and ample wharf accommodation.

The immediate hinterland is unproductive, but if the port were free it could serve an enormously rich hinterland in the Union. It has the disadvantage of being further from Europe than the Union ports, but for the purposes for which the port is largely used this disability is light compared with the advantage of the short rail haulage to the Rand.

About 850 vessels enter and leave the harbour annually. The principal exports (500,000 tons) are coal and fruit. Cargo landed amounts to 400,000 tons, consisting mainly of foodstuffs and machinery destined for the Rand.

CHAPTER XIII.

DISTRIBUTION OF POPULATION.

(Whilst in this chapter accurate figures are given wherever possible or desirable, it must be remembered that the basis of all statistics is the 1921 Census. Subsequent figures are only approximate, or accurate when the European population is discussed; the 1931 Census ignored the non-European population.)

The principal factors which influence distribution of population are (a) climate, (b) poverty or richness of soil, (c) altitude, (d) trade, manufactures and commerce, (e) mining, (f) transport, (g) immigration and emigration, (h) social attractions, (i) historical factors.

(a) In South Africa the principal climatic cause of population variation is rainfall. Sometimes an insufficiency of rainfall, seasonal or annual, is overcome by irrigation; irrigated areas are usually well settled. Areas where soil and altitude are favourable, and which have the right amount of rain at the right time, are densely populated. If the rainfall is variable and untrustworthy, settlement will be less dense and poverty greater.

West of the 20″ annual isohyet and north of the winter rainfall area, the average rainfall is both too little and too variable for the population to be anything but meagre; though certain regions, for reasons other than rainfall, have a fair density. East of the 20″ isohyet settlement is close and agriculture becomes perhaps as important as stock-farming, for here the rainfall is not only greater, but more trustworthy. Even in these areas, however, drought and frost occasionally cause great loss.

Where rainfall is heavy and temperature high, as in the Low Veld, Europeans do not settle closely, on account of the diseases to which man and beast are subject. There are very few areas in South Africa which are ' empty ' only because of temperature.

(b) The effects of good, moderate and poor soil are striking when studied in detail. The results, unlike those of rainfall deficiency, are not apparent over wide areas, but they have great local importance. The Cape Flats, for example, though they have a sufficiently good climate to grow Mediterranean crops abundantly, remain sparsely settled owing to soil poverty.

(c) The altitude of most of the Union permits the white man to live not only in comfort, but in conditions similar to those of Europe. In some parts of the Union, however, chiefly on the steep mountain slopes and the loftier parts of the escarpment, altitude discourages settlement.

(d) Trade, commerce and manufactures cause a concentration of population, whilst agriculture disperses population. In South Africa, apart from the Witwatersrand, the chief industrial and commercial centres are arranged around the coast. Many of the smaller centres are market towns ; in some instances (e.g. Bloemfontein) they have become larger for other reasons.

(e) Mining in South Africa has opened up desolate areas and caused dense populations to live in arid regions. Kimberley is a typical city in a poorly-watered district ; O'okiep is an example of the smaller type. Johannesburg is the world's greatest gold-mining centre : had it not been for gold, settlement on the Vaal-Limpopo watershed would have been sparse, and connected chiefly with pastoral life. Centres such as these attract manufactures, trade, commerce, transport, agriculture, market-gardening and dairy-farming, all of which swell the population. But it frequently happens that when mining activity ceases these towns wilt, especially those in regions of insufficient rainfall.

(f) Some settlement always occurs where routes converge, whether road, rail or river. Generally these ' nodal sites ' are in favourable climatic regions, but occasionally a junction-site is found in poorer regions and a transport town results. Such places are often convenient meeting-places, so that they have an importance greater than that warranted by the natural productivity of the area. South Africa has no Chicago, a typical nodal site, but De Aar typifies the junction-site.

(g) South Africa attracts few immigrants. Asiatics may not enter the country, whilst native labour, common to town and farm, discourages the settlement of unskilled Europeans. Moreover, the Government forbids wholesale immigration. Farming attracts only a few, because farming here is different from European farming ; moreover, it requires considerable capital. An increasing number of immigrants are retired people, who choose South Africa for its climate, beauty, and comparatively low taxation.

(h) Some districts, chiefly by reason of their situation, congenial climate and history, become notable educational, artistic and recreative centres. Big cities always tend to become bigger, and because of the facilities afforded by the accumulation of wealth they become artistic and fashionable. Government is usually localized in these towns. Pleasure resorts, again, are both the satellites and the parasites of large cities, as well as of great

countries. Their population is a fluctuating one, but usually they grow as wealth increases, and as more people in the country become old and retire. The number of people in our larger cities who cater for ' amusements ' of all kinds is considerable.

All these ' social ' factors account for a not unimportant section of the population of our great cities. Cape Town, Johannesburg, Durban, Pretoria and Bloemfontein are typical.

DISTRIBUTION OF EUROPEANS.

[One dot denotes 1000 people ; the squares represent towns having populations exceeding 20,000.]

(i) Towns which are in being, other than mining towns, may decay slowly, but more often they grow ; they develop in accordance with the principle called ' geographical inertia.' Established cities have a greater tendency to growth than new cities. Roads and railways have been added to the original factors which caused the settlement to be founded ; government, education, manufacturing, trade, banking, assurance, and all the professions, find it convenient to have their centres in a big town.

The absence in South Africa of large alluvial plains is largely responsible for the absence of a dense agricultural population. The average density of the Union is low. In 1921 the total population of the Union, the Protectorates, Southern Rhodesia and South-West Africa was 8,814,231, of whom only 1,578,091 (18%) were Europeans. To-day (1932) the average density of population in the Union only is approximately 15 per square mile. (The densities and total population of the other areas will be

Photo.] *C. V. Hougaard, Esq.*

BANTU, NORTHERN TRANSVAAL.

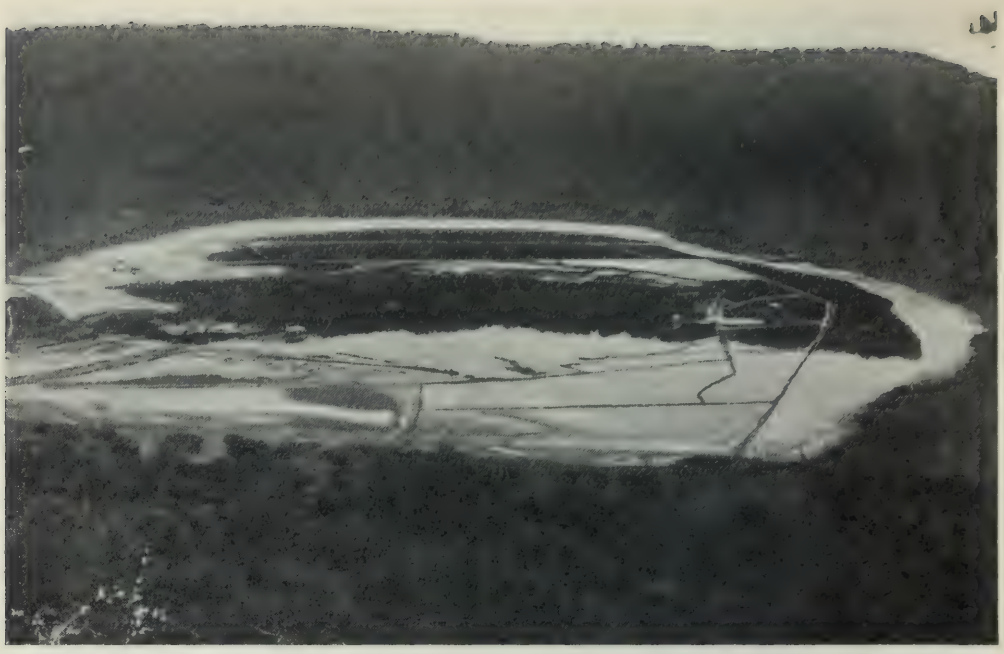


Photo.] [*Dr. A. L. du Toit.*

PRETORIA SALT PAN.

Photo.] [*S.A.R. Publicity Department.*

KRANTZ KLOOF, NATAL.

discussed later.) In 1921 the total population of the Union and of the respective Provinces was as follows :

	European.	*Non-European.*	*Bantu.*	*Asiatic.*	*Mixed.*
Cape Province ...	650,609	2,132,110	1,640,162	7,696	484,252
Natal	136,838	1,292,560	1,139,804	141,649	11,107
Transvaal ...	543,485	1,544,151	1,495,869	15,991	32,291
O.F.S.	188,556	440,271	421,978	395	17,898
Union	1,519,488	5,409,092	4,697,813	165,731	545,548

The small proportion of Europeans to non-Europeans is one of the vital social and geographical problems in South African life. There are about seven non-Europeans to two Europeans, and, although it is not the function of geography to discuss the Native Problem, it is proper to draw attention to this disparity. The distribution and character of our population may be studied most conveniently if the provinces and other territories are considered separately.

Cape Province. There is the greatest disparity in the Cape between various districts. In the S.W. region the density considerably exceeds the Union average : in the N.W. districts vast areas have scarcely a single inhabitant. The area of the Cape is nearly 59% of that of the Union, but the population is only slightly over 40%. Its population per square mile (hereafter called 'density') is the lowest in the Union ; in 1921 it was 10·05. The European density is only 2·6 ; the non-European density is four times as great. When, however, the urban population is subtracted from the total, we see that rural areas are most sparsely populated. The rural density is 8 (Europeans 2, non-Europeans 6). It can be seen from the atlas that much of the Karroo and Bechuanaland have a density of less than 1. The drier districts are practically devoid of settled population ; there is some settlement at waterholes, wells, and along rivers. Typical of this area is Gordonia, with a density of 7 persons to every 10 square miles.

The density of the urban districts is not high compared with European countries, but is very high in comparison with rural areas in the Union. Cape Town has a density of about 500 and Port Elizabeth 308. Many of the smaller towns have a low density, as they cover so large an area. Cape Town is the largest city, the approximate populations (1932) of this city, Port Elizabeth and East London being respectively 284,000, 75,000 and 55,000. In these towns the European population comprises about half the total.

Orange Free State. This province has the most evenly distributed population of all the provinces, reflecting the agricultural conditions of the eastern and central districts and the moderately 'heavy' pastoral industry of the drier west. Most

of the small but evenly distributed towns are more than 4,000 feet above sea-level. In the western 'rain-shadow' area, the towns are smaller and more widely spaced.

The population exceeds 660,000, about two-thirds of whom are not white. The average density is 12·67; the rural density is 9·96. Bloemfontein is the only large town, and its population is only 55,000. The only other town whose population exceeds 10,000 is Kroonstad. Most of the others have a local importance only. Like most of the rivers of the Tableland, those of the Orange Free State are too deeply trenched for towns to grow up near their banks.

Distribution of Asiatics.
[One dot denotes 1000 people.]

Natal. The area of this province is 35,284 square miles; its population in 1921 was 1,429,398. Natal is thus the smallest of the four provinces (7·47%); but it has 20·63% of the population of the Union, representing also the highest density (40·51). Owing to even temperatures, good rainfall, and the possibility of close agriculture, the coastal lowlands may be described as almost densely populated. Areas with an elevation of over 4,500 feet, however, are sparsely populated.

The towns, of which there is a considerable number, are evenly distributed, except in the western highlands and in Zululand; in the lowlands of the latter there is an almost complete absence of even the smallest towns. The largest town is Durban (population 151,000; density 1475); about one-third of the population is European. Pietermaritzburg is the only other large town, whilst the third largest is Ladysmith (about 6,500). Most of the other towns have less than a thousand inhabitants.

An important feature is the large proportion of Asiatics, who constitute nearly one-tenth of the non-European population. The mean density of the non-European population (36·63) is the highest in the Union, whilst the total non-European population is only exceeded by that of the Cape Province and of the Transvaal, where a high proportion of the natives are urbanized. The European density is only 3·88; two-thirds of this number represent urban dwellers. The rural density of the non-European population is 34·38.

Transvaal. The greatest urbanization in the Union is on the Witwatersrand. Here conditions are almost European; as regards the Southern Hemisphere they are unique. Except for two great cities in Europe (Birmingham and Lwow), Johannesburg is the only large town built on a watershed. It is valleys that attract settlement; watersheds usually repel. It is only the enormous mining development of the Witwatersrand that has been responsible for this geographical phenomenon.

Elsewhere the population of the Transvaal has no striking peculiarities. North of the capital only the higher areas overlooking the Limpopo have a density of more than 9; parts of the Low Veld are practically unpopulated. So also are the higher regions of the escarpment. Some of the valleys in the neighbourhood of Pietersburg, Potgietersrust and the Crocodile have fairly dense settlements, but in the large Rustenburg and Waterberg districts the density is usually less than 5.

South of the Rand the density is higher than the Union average, for the large towns provide a market for the produce of the fairly well watered countryside. Of the nine most densely populated districts in the Union five are found in the region stretching from Krugersdorp to Barberton and southwards towards Standerton; in 1921 densities were as follows: Johannesburg 1605, Benoni 678, Boksburg 506, Germiston 462, Springs 200. Johannesburg, the third largest town in Africa, has a population of over 300,000.

The rural density in the Transvaal is 13; the European rural density averages only 2. The province has an area of 110,450 square miles (23·4% of the Union), and is the home of over 30% of the Union's population. In 1921 the average distribution of population was nearly 19 to the square mile; about 47% of the total European population lived in towns. The factors limiting the greater growth of the rural population are drought, poverty of soil, the unhealthiness of the Low Veld and the altitude of the Drakensberge. If the gold should be worked out quickly, the Rand will lose its population in a short time. It is more likely,

however, that the production of the mines will decrease steadily, so that agriculture and other industries will to a great extent replace mining.

As in all young countries, there are more males than females in South Africa, although this disparity is slowly disappearing. At present there are about 106 male Europeans to 100 females and about 104 non-European males to 100 females.

South Africa is a healthy country. The European death rate is about 9·85 per 1000, whilst the birth rate is about 26 per 1000. The native and coloured birth and death rates cannot be determined, but they are certainly higher than the European.

Apart from the control of diseases, a good water supply is important to the health of a people, particularly in urban districts. In the Union the supply of water is a matter of great difficulty for big municipalities. It depends largely upon geographical factors whether water is plentiful and cheap all the year round or not. Cape Town has had to spend nearly £5,000,000 in making reservoirs on Table Mountain and in the Steenbras Valley 40 miles away. In such a district which has little summer rainfall (when evaporation is great) it is possible to get water only by building reservoirs or by sinking wells.

In the Transvaal the huge urban growth on the Rand desires plentiful water to supply the ordinary and mining needs. Originally boreholes and shafts at Zuurbekom supplied most of the water, and later the Klip River Valley. Since 1922 most of the supply has come from the Vaal, 25 miles from Vereeniging. Over £5,500,000 has been spent on these schemes. Kimberley also receives its water supply from the Vaal, whilst Durban uses the Umlaas River.

The Non-Europeans. In 1921 over 55% of the European population but only 16½% of the non-European population was concentrated in towns. Most of the Bantu live in native areas, but the other non-Europeans live in closer proximity to whites. It is only in the Transvaal that the Bantu are found in great numbers in towns; nearly one-quarter of the total number in the province are urban dwellers. In the Cape Province and Orange Free State respectively there are thirteen times and six times as many natives in rural districts as in urban. In Natal there are fewer non-European urban dwellers, for of 1,085,256 natives only some 55,000 live away from rural areas.

The great desire of the natives is to own land. Unfortunately, however, very little land remains which is not in white possession. The problem is a serious one. In times of drought suffering among the native population is intense. Their land is overstocked with scrub-cattle and their agricultural methods are primitive. Their customs militate against improvement, but so long as they remain agriculturalists it is very difficult to change their customs, and there is no desire to make them come to the towns. Fortunately, much of the area peopled mainly by the natives is fairly well watered and fertile. If methods of avoiding overstocking, of eradicating the scrub bull, and of preventing soil erosion were

adopted, the carrying capacity of the land could be greatly increased.

It is not probable that the natives are increasing faster in proportion to the whites. In the Cape in 1921 they formed about 59% of the total population, and were centred largely in the eastern districts and the native territories. In the Transkeian Territories they numbered 938,990, representing a density of 57·41, which is much above the Union average. In the King

DISTRIBUTION OF BANTUS.
[One dot denotes 1000 people.]

William's Town area there were nearly 100,000, with a heavy density of 70. In the rest of the Province they were widely scattered, and lived mostly in or near towns.

In Natal about a quarter of a million natives live in Zululand, where the soil is not so fertile as in the Transkei. The total for the province is about 1,140,000, representing about 80% of the entire population. But the distribution is fairly even, and thus the density, although high, is only 36.

In 1921 the native population of the Transvaal numbered 1,495,869, viz., 72% of the total population of the Province; the average density was 13·5. The greatest concentration was in the urban districts, with a high density of 160, and in certain well-watered areas like the Lydenburg and Zoutpansberg districts.

The native population of the Orange Free State, in 1921 numbering 422,000, is fairly evenly distributed, with some concentration in the Harrismith and Bethlehem districts. The average density is 8·5.

In 1921 the coloured and mixed races formed about 8% of the total population of the Union (Cape Province 485,000 Transvaal 33,000, Orange Free State 18,000, Natal 11,000). In

DISTRIBUTION OF MIXED AND COLOURED PEOPLES.
[One dot denotes 1000 people.]

the same year the Asiatic population was approximately 166,000 (Natal 141,000, Cape Province 8,000, Transvaal 16,000, Orange Free State 400). Except in Natal Asiatics are practically confined to the towns.

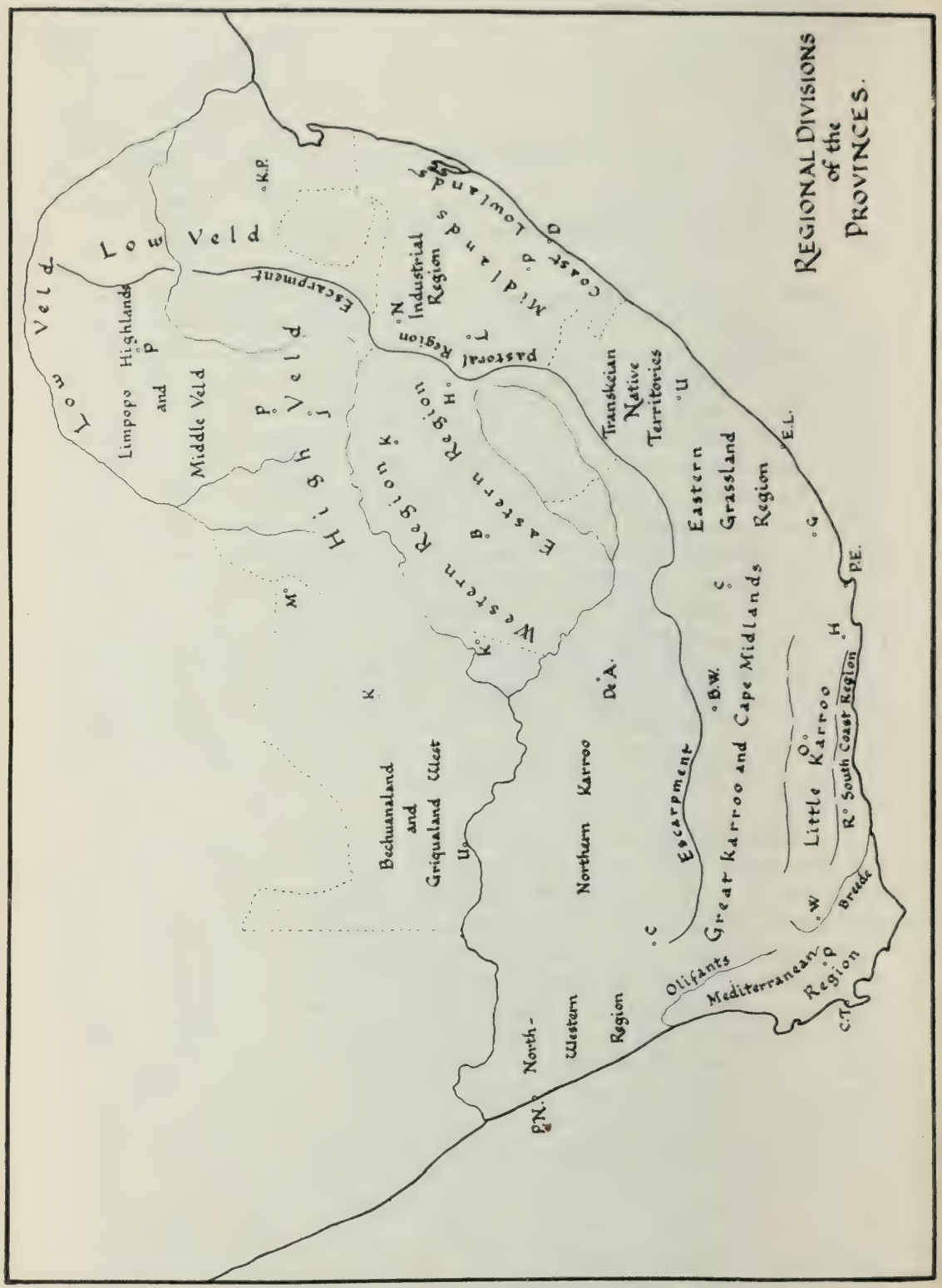
CHAPTER XIV.

REGIONAL DIVISIONS.

Introduction. The division of a country into regional units is perhaps the most difficult of geographical problems. Even when our object is to discover merely *natural* divisions, the physical conditions must be investigated with extreme care before we can decide which of them may be held to give a region its distinguishing characteristics. For example, it is customary to contrast the midland area of Natal, consisting of meadow and woodland, with the grass-covered country nearer the Drakensberge. What is the physical reason for this difference in vegetation ? Elevation has been held to be the determining cause, on the principle that in a region of diversified elevation the lowlands are mainly agricultural and the uplands pastoral. In this case, however, the generalization does not fit the facts. The Upper Tugela basin, a purely pastoral area, is on the whole *lower* than the agricultural and woodland region occupying the centre of the Province (cf. Colenso 3,156 feet ; Greytown 3,581 feet). Hence in searching for factors that distinguish Western Natal from the Midlands altitude must be rejected in favour of other physical conditions.

The introduction of the human or occupational element into our conception of regional divisions complicates the problem still further ; yet these new difficulties must not be shirked, for sometimes of all the factors that give a region its character and unity the human factor is the most important. Indeed, it may be questioned whether the study of purely natural regions is of any great practical utility, for geography is not merely the study of the natural world, but of the earth as the home of man. Thus it is often necessary to distinguish, for ' human ' reasons, between areas physically identical. It is, for example, proposed in the next chapter to separate the native territories of the Cape Province from the remainder of the South-Eastern Region, although natural conditions alone would not warrant such discrimination.

Other instances occur in South Africa of areas, physically similar, that possess an individuality of their own arising from conditions of history and outlook. In fact, it is on these grounds that we justify a first broad division of the Union into its four component provinces. Merely in respect of natural conditions


Regional Divisions of the Provinces.
Low Veld
Limpopo Highlands and Middle Veld
Escarpment
High Veld
Low Veld
K.P.
N. Industrial Region
T. Pastoral Region
Coast Lowlands
Transkeian Native Territories
U
Eastern Grassland Region
E.L.
G
P.E.
H
R° South Coast Region
Little Karroo
O°
W
Bredé
Great Karroo and Cape Midlands
Escarpment
B.W.
C
Olifants
Mediterranean Region
C.T.
North-Western Region
P.N.
Northern Karroo
De A.
Bechuanland and Griqualand West
Up
K
M°
Western Region
K°
Eastern Region
B°
H°
K

the High Veld of the Northern Orange Free State is scarcely distinguishable from that beyond the Vaal; but the economic life of South Africa is still somewhat provincial, and while the former region looks southward to Bloemfontein, the latter looks toward Johannesburg and Pretoria. The four provinces of South Africa are distinct not only in a political sense; each has its characteristic economic *atmosphere*.

We have seen that the effect of the human factor is sometimes to render distinct areas that are physically similar; in other cases it has a converse result. Areas naturally unlike each other may develop, under the stimulus of man's influence, along common lines. Thus Worcester, with a rainfall of only 13 inches, and natural vegetation of a typically Karroo kind, falls inevitably into the Mediterranean region in virtue of the cultivated products the district is made to yield; suitable methods of farming have overcome adverse natural conditions.

In our search for regional divisions we shall therefore take note of physical factors like relief, climate, natural vegetation, and geology (which is concerned with minerals and soils), but chiefly for the purpose of discovering and explaining the characteristic *occupations*, arising out of these natural conditions, that give an area its essential unity. To take an example, we shall distinguish between the Great and Little Karroo not merely because of physical differences, but also, and more particularly, by reason of the occupational differences to which the physical contrast gives rise.

It will further appear that in the determination of occupations the various physical factors differ in significance as between one area and another. Both in the Orange Free State and in Natal the principal determining factor is rainfall; but rainfall has very little to do with the characteristic features of the Transvaal divisions. In Northern Natal the principal distinguishing element is a geological one—the existence of coal and iron. Even the human factor is not uniformly important; it is of little account in undeveloped areas like the Northern Transvaal.

A description of regional units cannot but involve the repetition of information already given in earlier chapters, but the point of view is now *local*, and therefore perhaps more definitely geographical; for opportunity now occurs for the setting down of exact topographical information, to which, possibly, modern geographers pay too little attention.

CHAPTER XV.

THE CAPE PROVINCE.

The Cape Province is the largest of the four provinces of the Union, and also, both structurally and climatically, the most diversified.

Contrasts in relief appear in the beautiful mountain scenery of the South-Western districts, the undulating grasslands beyond the Great Fish River, the level steppe of Bechuanaland and the Northern Karroo, and the stark mountains of the North-West.

Climatic contrasts are equally apparent. Occupying the extreme southern end of the African continent, the Cape Province is washed by two oceans whose differences of temperature contribute to an important contrast between the climate and vegetation of the western parts of the Province and those of the eastern.

The contrast is not only between east and west ; many instances might be given of areas quite close to each other which show astonishing differences in productiveness. The Namib desert begins only a few miles to the north of the orchards and grainlands of the winter-rainfall area ; the Knysna forests are separated from the stony wilderness of the Little Karroo only by a mountain range.

The Cape Province is seriously menaced by drought, and as a remedy irrigation is almost a negligible factor. Throughout two-thirds of the Province the annual rainfall is less than 15″, and farming methods, instead of aiming at overcoming this disadvantage, often accentuate it.

The fact that the two northern provinces have no coastline lends an added importance to the harbours of the Cape Province. Of the four largest ports serving the inland provinces and the Rhodesias, three are situated in the Cape Province. Moreover, many of the railway routes that traverse certain parts of the Province were constructed not to meet the needs of economic development in these areas, but to serve rapidly-expanding regions beyond the Orange, Vaal and Limpopo.

The Cape Province falls into the following Regional Divisions, which will be described separately :

(1) The Mediterranean Region. (2) The South Coast Region. (3) The Little Karroo. (4) The Great Karroo and Cape Midlands. (5) The Northern Karroo. (6) Bechuanaland and Griqualand West. (7) The North-Western Region. (8) The Eastern Grassland Region. (9) The Transkeian Native Territories.

THE MEDITERRANEAN REGION. The approximate boundaries of this south-western region are the Olifants and Breede Rivers, although the transition to Karroo and to South Coast conditions is a gradual one. Generally speaking, the region is free from hailstorms, locusts, and unseasonable or prolonged droughts, and is the home of prosperous farming communities. The chief product of cultivation is the vine, but almost every kind of deciduous fruit is grown; citrus orchards are also numerous, but

TABLE BAY FROM TABLE MOUNTAIN.

require irrigation in summer. The dry summers favour fruit-drying and the curing of tobacco. The Caledon and Malmesbury districts are well suited to the production of cereals, particularly wheat.

The principal natural assets of *Cape Town* are Table Mountain, 3,500 feet in height, and Table Bay. The mountain not only lends beauty and distinction to the city, but by condensing moisture from the Atlantic creates a rainfall without which no settlement could have grown up.

With its highly-productive immediate hinterland and its facilities for importing raw material from abroad, Cape Town is not merely a port but a busy industrial city. Its manufactures are represented by grain mills, breweries and distilleries, cement and lime works, jam factories, woollen mills, furniture factories, tobacco factories, biscuit and confectionery factories, coach and wagon works, boot and shoe factories, railway workshops, tanneries, soap factories, saw-mills and fish-canning factories. Cape Town is also a cathedral city, and an important cultural and educational centre. Since 1910 it has been the legislative capital of the Union. The population numbers 284,000.

The rugged coasts of the Cape Peninsula converge at Cape Point, forty miles to the south of Table Bay. The eastern shore of the Peninsula forms the western shore of False Bay, so named because the early navigators mistook this shore for the East Coast of Africa. Apart from holiday resorts the principal False Bay settlements are Kalk Bay, a fishing harbour, and Simonstown, the headquarters of the naval squadron. The Constantia valley produces wines whose European reputation dates back more than a century. The whole peninsula has very great scenic attractions, and annually thousands of holiday-makers visit the various little resorts, of which Muizenberg is the most famous, particularly for its fine surf-bathing.

Paarl (17,000) and *Wellington* (6,000) stand at the southern end of the picturesque and fertile valley of the Berg River. Both are centres of prosperous fruit and wine districts. The former town derives its name from three enormous granite boulders that crown the Paarl mountains, which lie to the west of the valley ; good granite is quarried in these mountains. Eastwards rise the summits of the Drakenstein Range, which affords shelter from the south-east wind. The district is probably the most important wine-producing area in South Africa ; nearly two hundred varieties of vines are cultivated experimentally at the Government Viticultural Station. The town itself, which straggles along the banks of the river for about seven miles, is a busy industrial centre ; wool-washing, the distilling of brandy, wagon-building, weaving and harness-making are among the more important occupations.

Wellington, nine miles to the north of Paarl, is the centre of a district in which fruit-growing predominates. The drying of apricots, pears, peaches, prunes and grapes is especially important. Turkish tobacco grown in the district is manufactured in the town, which, like Paarl, is the home of many industries, including milling, tanning, and jam-making. Wellington is also an educational centre. To the east of the town the Drakenstein mountains are crossed by a pass known as Bain's Kloof, which provides the shortest route from Cape Town to Worcester. The gradient, however, is too steep for the railway, which reaches the Breede Valley only after a long détour to the north by way of Tulbagh Kloof.

Tulbagh, *Ceres* and *Worcester* are rain-shadow areas, but are well-irrigated. Wine and fruit are the chief products. Tulbagh lies in the shadow of the lofty Witzenberge, near one of the tributaries of the Berg River ; northwards one may catch glimpses of the Great Winterhoek, the highest peak in this part of the province.

The road to Ceres (2,000) traverses Michell's Pass, down which flow the headstreams of the Breede River. The pass is remarkable for its twisted and steeply-folded strata, witnessing the giant forces that have gone to the making of fold-formations in this area. Ceres itself is a picturesque little town watered by the Dwars River, which flows into the Breede. The Bokkeveld, which lies beyond the summit of the pass, has a cold winter climate well suited to the production of apples and pears.

Worcester (10,000) stands at the convergence of two valleys : that of the Hex River, a tributary of the Breede, and that of the Breede itself. In this district is to be found some of the most valuable irrigated land in the Union : indeed, the contrast between the fertility of the farm-lands and the sterility of the surrounding mountains is one for which it would be difficult to find a parallel. Wine and raisins are the chief products ; there is also a considerable export of fresh fruit. Some stock-farming is carried on, especially the rearing of thoroughbred horses. Other industries include tanning, wagon-building, and the distilling of brandy. Worcester is the dividing-point between two great railway-routes : the main line to the north, which climbs the Hex River Pass and emerges upon the Great Karroo, and the Garden Route which follows the valley of the Breede.

Between the Drakenstein mountains and the sea lies another important group of wine and fruit districts, comprising *Stellenbosch*, *French Hoek*, *Villiersdorp* and *Somerset West*.

Stellenbosch (8,000), is next to Cape Town, the oldest settlement in South Africa. The town is one of exceptional quaintness and charm. Streams of clear water and fine oak-trees border the cool streets, whilst bell-towers and gabled homesteads preserve an atmosphere of history difficult to match elsewhere in South Africa. Stellenbosch is also one of the principal educational centres in the country. Rivers all over the Union are being stocked with trout from the Government trout-hatcheries at Jonker's Hoek, some five miles towards the source of the Eerste River.

Beyond Stellenbosch a pass known as Helshoogte leads to French Hoek, founded early in the 18th century by Huguenot refugees. Many orchards and vineyards in the district are still owned by descendants of the original settlers. Fruit and Turkish tobacco are grown in the neighbourhood. Villiersdorp and Elgin are noted especially for their apple and pear orchards; Elgin has many square miles of afforested land. Somerset West (3,000) stands in a horse-shoe valley surrounded by the Hottentots Holland mountains; it has large factories where explosives, fertilizers, sheep-dip, disinfectants and other chemicals are manufactured. The nearby 'Flats' are slowly being taken up by market gardeners.

Caledon (3,000) is the principal town of the triangular-shaped block of hilly country which stretches southwards to Cape Agulhas. Mountain and valley are here less pronounced than in the regions just described, and the gently-undulating country affords excellent grazing and arable land. The region is one of prosperous farming communities. Cattle-rearing, dairying and the cultivation of fruit are important, but wool and grain are the chief products. Caledon also possesses hot-springs, which have been known since the earliest days of the Dutch occupation.

Bredasdorp (3,000) is the centre of a district producing wool, grain and tobacco. Along the neighbouring coast oyster-fisheries are important.

Genadendal, near the Zonder Einde River, is the oldest mission settlement in South Africa; over a thousand plots have been carefully irrigated, providing a livelihood for a large number of non-Europeans.

The region between the Berg River and the Atlantic is comparatively low-lying, and has only a moderate rainfall. Around Darling dairying is the principal industry; elsewhere wheat is extensively cultivated. *Malmesbury* (4,000) is a health resort laid out around mineral springs; it also makes wine. *Moorreesburg* (4,000) is a busy milling centre. Malmesbury, Moorreesburg and Piquetberg are linked up by a railway which runs as far as Bitterfontein.

Saldanha stands on a deep natural harbour, but owing to its arid hinterland has never become a great port. Saldanha Bay is used chiefly as a whaling station. Granite used in Cape Town for road-making is quarried in the neighbourhood.

Clanwilliam (2,000), on the Olifants River, marks the northern limit of Mediterranean conditions. Around Citrusdal there is good irrigation, but further north farmlands suffer from lack of water. Oranges and grain are the chief products and sheep farming is carried on, although the pasturage is poor. There are Government cedar plantations on the slopes of the Cedar Berge, although throughout this region the mountain-slopes are usually rugged, and almost devoid of vegetation.

The South Coast Region. This region may roughly be defined as that part of the Coast Plain extending from the Breede River to St. Francis Bay. To the north its boundary is the line of coast ranges known as the Lange Berge, the Outeniqua, and the

Lange Kloof Mountains. From the Breede River to Mossel Bay the region attains a width of 30 miles, but eastwards the mountains approach nearer the coast. The coast itself is not finely indented, but consists of a number of broad sweeping bays, the intervening capes often being formed by southward-trending spurs of the coast ranges. The strong currents that set in this part of the Southern Ocean, aided by the prevailing south-east wind, have produced scenery which is rocky and rugged in the extreme.

Rainfall in the South Coast Region occurs throughout the year, but varies greatly in amount, and to a lesser degree in seasonal distribution. The western districts share the winter rains of the Mediterranean region, but eastwards the rainfall is heavier in summer.

From George to Humansdorp, a distance of about 100 miles, the rainfall in many districts amounts to 40 inches annually ; the region is therefore splendidly wooded, the chief factor distinguishing these famous forests from those in the south-eastern part of the Union being the abundance of keurboom. ' Virgin timber ' is becoming exhausted, although areas which have been cleared are being replanted. Furniture, wagons, fencing-posts, railway-sleepers and floorboards comprise the chief articles manufactured in the forest region. Kamassi wood is exported to Europe ; it is used in the making of weavers' shuttles.

While the forests constitute the principal source of wealth, the generous rainfall of this region is utilized in the production of maize, wheat, apples, pears, citrus fruits, bush-fruits, hops and vegetables. In certain areas, however, agriculture is restricted owing to sourness of the veld ; carbonates and other salts have been leached out of the soil by the heavy rains. Another natural condition unfavourable to the cultivation of grain is the wetness of the ripening season.

To the west of Mossel Bay the coast plain receives an annual rainfall of only 17″, but the district may be included in the South Coast Region both on account of its situation to the south of the coast ranges, and because of the fairly even distribution of its rainfall. The veld consists of scrub and stunted bush, thus combining the characteristics of the Mediterranean region with those of the Karroo. Sheep-rearing, dairy-farming and the cultivation of grain are typical occupations. Since rains fall at all seasons, stock find good grazing throughout the year.

Swellendam, *Heidelberg* and *Riversdale* all lie in the shadow of the Lange Berge, and utilize for purposes of irrigation the waters of small streams that have their source in these mountains. *Swellendam* (3,000) is principally a stock-raising centre ; but grain, tobacco and fruit are obtained from the fertile alluvial lands that border the Breede River. The district of *Heidelberg* produces wool, grain, tobacco and aloes. *Riversdale* (3,000), on the Kafir Kuils River, is the market-town for a large stock-raising and agricultural

district whose chief products are wool, grain, fruit, dairy produce and heath-honey. *Mossel Bay* (6,000) exports many of the products of the Little Karroo, as well as those of the districts just described. Local industries include milling, tanning, and the making of boots and shoes. Fishing and fish-canning are also important. There are also valuable oyster-fisheries. *George* (6,000) a scattered little city of well-tended gardens and cool oak-shaded streets, stands midway between the Outeniquas and the sea. The Montagu Pass, three miles to the north of the town, leads over the mountains to the Little Karroo. In addition to the occupations afforded by the surrounding forests and plantations, dairying, fruit-growing and pig-rearing are carried on locally.

The district between George and Knysna is one of the best watered and most beautiful parts of the Cape Province. Here is situated the Wilderness, a holiday resort famed for its mountain, woodland, and river scenery. The mouths of most of the rivers that traverse this section of the South Coast Region expand to form lagoons, and it is on the shores of one of them that Knysna is built; the town is hemmed in by a horse-shoe of green hills, the two ends of which form the 'Knysna Heads.' Railway sleepers and timber for making furniture and wagons are important exports. A timber railway winds through the forest for 22 miles, terminating at *Deepwalls*.

Humansdorp (3,000), only 70 miles from Port Elizabeth, marks the limit of the South Coast Region. Here again there are forests and much fine scenery.

THE LITTLE KARROO. This region affords a good example of a geographical unit in which relief, climate and vegetation are distinctive and harmonious.

Westwards the region may be said to extend as far as the Breede River. Eastwards the Little Karroo stretches approximately to Uniondale, beyond which the country becomes more diversified and belongs rather to the Cape Midlands. The Zwarte Berge form the northern boundary, while southwards the Lange Berge and Outeniqua Mountains divide the Little Karroo from the Coast Region. Dense forest covers the seaward side of these coast ranges, but their northern slopes, although majestic and rugged, appear stark, uninviting, and almost destitute of vegetation.

The climate of the Little Karroo is remarkably healthy. The air is dry and bracing, and in winter the region receives a maximum amount of warm sunshine even when snow is lying on the surrounding mountains.

The Little Karroo itself is a gently undulating plain drained by the Gouritz River and its two chief tributaries, the Olifants and Groote Rivers. Although these streams do not flow perennially, their waters are utilized for irrigation, notably in the districts of *Oudtshoorn* and *Calitzdorp*. Owing to the scanty and uncertain character of the rainfall, which seldom exceeds 12″ annually, the veld generally presents a dreary appearance. The soil, however, is wonderfully fertile, and after rains have fallen flowering veld-plants spring up and cover the ground like a brightly-coloured carpet. The vegetation is more pronounced and more varied than that of the Great Karroo; indeed, the Little Karroo produces a number of the most interesting plants found in South Africa.

Even in the rainless season the Karroo bush remains, affording sufficient nourishment for sheep as long as the farmer can provide the animals with water.

Other pastoral industries are the rearing of cattle, horses, goats and pigs. Where water can be obtained, these industries are carried on under almost ideal conditions. The dairy industry is making progress, whilst the dry climate favours poultry-farming. In districts where irrigation is carried on lucerne, tobacco, fruit, wheat and vegetables are grown in abundance ; the finest tobacco grown in the Cape Province comes from the *Oudtshoorn Valley.*

Oudtshoorn (11,000), the largest town of the Little Karroo, stands in the midst of a fertile valley sixty miles in length and five miles wide, watered by the Olifants and its tributaries. Additional water-supply comes from the Kamanassie Dam, completed in 1924, and from the Zwarteberge. Oudtshoorn is thus the market for a large and important irrigation district ; it also carries on manufacturing industries in which a variety of local farm-products are utilized. At the foot of the Zwarteberge, 18 miles north of the town, are situated the Cango Caves. These strange caverns extend underground for over two miles ; their stalactities are among the finest in the world. Marble is found in the neighbourhood.

Uniondale, near the source of the Kamanassie River, occupies the gap between the Kougo and Kamanassie ranges. The district is better watered than most parts of the Little Karroo and produces grain, tobacco, lucerne and fruit in abundance. About 15 miles to the north of the town a pass, known as Tover Water Poort, carries the railway from Oudtshoorn over the Zwarteberge to Willowmore on the Great Karroo.

Montagu (2,000), at the western extremity of the Langeberge, stands upon a tributary of the Breede River. It is noted for the distilling of brandy. Two miles away there are hot springs whose radio-active waters have long been known.

Calitzdorp is situated near a gap in the Zwarteberge occupied by the Gamka River. The surrounding lands are exceptionally fertile, and, irrigated by furrows from the Nels River Dam, produce heavy crops of lucerne, grain and tobacco. 20 miles to the west is *Ladismith*, whose chief products are grain, feathers, brandy and calabash-pipe gourds. *Avontuur*, near Uniondale, is the starting-point of a narrow-gauge railway which runs down Lange Kloof to Humansdorp, and thence to Port Elizabeth.

The Great Karroo and Cape Midlands. It might be possible to separate these two regions, but only on structural grounds. The Great Karroo has a well-defined southern boundary, viz. the Zwarteberge, and is generally of fairly uniform elevation. The Midlands, on the other hand, are not to the same extent cut off from the sea by coast ranges, and have a more diversified relief. But here the contrast ends. It is true that the Midlands have a superior rainfall (e.g., Prince Albert 8″, Beaufort West 10″, Aberdeen 13″, Cradock 16″), but everywhere the rainfall is so variable from year to year, and from place to place, that it would be extremely difficult solely on grounds of rainfall, vegetation, and farm-industries to decide where the Karroo ends and where the Midlands begin.

Photo.] [*C. V. Hougaard, Esq.*

BASUTO.

Photo.] [*Dr. A. W. Rogers.*

FALLS ON TSITZA RIVER, C.P., OVER DOLERITE SHEET IN BEAUFORT BEDS.

Photo.] [*Dr. A. L. du Toit.*

PLATEAU OF NAMA BEDS (SHALES AND LIMESTONES) ABOVE KONKIEP RIVER, S.W.A.

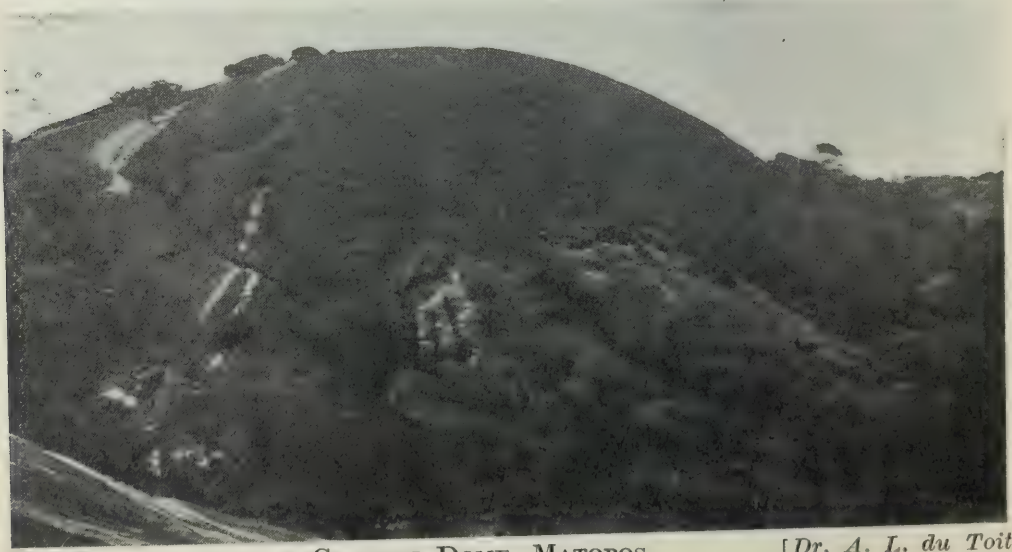


Photo.] GRANITE DOME, MATOPOS. [*Dr. A. L. du Toit.*

The most characteristic occupation of the entire region is sheep-farming; merinos predominate in the Midlands, and where 'spekboom' veld occurs the rearing of Angora goats is also important. Fodder crops, grain, fruit and lucerne are the principal products of cultivation in irrigated districts. Dairying is carried on, especially along the Sundays River.

The farmer is largely dependent upon donkeys, oxen and motor-lorries for the transport of produce, for, although this region has an extent of three hundred miles from west to east, it has very few railways.

Matjesfontein stands at the western end of the Karroo, and in common with other small towns of this region enjoys a reputation as a health resort.

Laingsburg (2,000), also on the main line to the north, is surrounded by rugged mountainous country in which some of the head-streams of the Gouritz River have their source. There is some cultivation of wheat, hay and lucerne, and formerly fruit-growing was carried on; but owing to prolonged droughts these industries have declined. At present the only occupation of importance is sheep-farming.

Prince Albert (2,000), thirty miles to the south of the railway, is within twelve miles of the Zwarteberge, which are crossed by a wonderful pass, the principal connecting link between the Little and the Great Karroo. Since the mountains yield an excellent water-supply, the town is surrounded by green orchards and cultivated fields.

Beaufort West (7,000), the principal town of the Great Karroo, lies at the foot of an eastern spur of the Nieuwveld Mountains; and, the continuity of the great escarpment being somewhat broken at this point, it is just beyond Beaufort West that the main line leaves the Great Karroo and climbs to the higher levels of the Northern Karroo. The town is an important wool and cattle market, and has railway workshops.

Graaff-Reinet (12,000), 'the Gem of the Karroo,' is the oldest and largest town of the Midlands; it possesses an unfailing and plentiful water-supply, drawn from the Sundays River, and displays to advantage the wonderful fertility of the Karroo soil. The dam at Van Ryneveld's Pass irrigates the surrounding valley-lands, in which the breeding of pedigree cattle is important. The farming population is mainly agricultural, however; lucerne, fruit, and even the vine are extensively cultivated.

The fertile district of Graaff-Reinet is one of sharp contrasts within short distances, for not far from the town a steep climb brings one to a hill-crest overlooking the Valley of Desolation, an awe-inspiring wilderness of loose boulders and heaped-up rocks, from the midst of which rise great pillars of basalt hundreds of feet in height. *Aberdeen* (3,000), some 40 miles to the south-west of Graaff-Reinet, and *Jansenville*, on the Sundays River, are centres of stock-raising districts. The country surrounding *Willowmore* is remarkable for its river-terraces, which in some cases have been cut into the hill-slopes hundreds of feet above the present channels.

Forty-two miles below Jansenville is Lake Mentz, the second largest irrigation dam in the Union. From this point to the sea the Sundays River valley is wide and fertile, and filled with deep alluvial soil; with irrigation progress in dairying and fruit-growing is expected.

Uitenhage (19,000), on the Zwartkops River, and well provided with water from the Great Winterhoek mountains, is the centre of a pleasant sheep-farming district noted also for fruit and flowers. The town itself has large railway workshops, wool-washeries, and a tannery.

Port Elizabeth (75,000) is the second city of the Cape Province and the third port of the Union. Algoa Bay, round whose shores the town now stretches for 5½ miles, was first visited by Bartholomew Diaz in 1486, but no settlement occurred till after 1820. The town is noted for its wool and feather markets, and owing to its central position has recently become an important centre of the motor industry. Manufacturing industries include the making of boots and shoes (employing 2,000 workers), engineering, furniture-making, milling, the making of soap and candles, and the preparation of all kinds of foodstuffs.

Within the basin of the Great Fish River, which, like the Sundays River, has large irrigation works, lie Middelburg, Cradock, and Somerset East. The railway route from Port Elizabeth to the north follows the main valley.

Photo.] [*Rev. H. Luscombe.*

SPANDAU KOP, GRAAFF REINET.

Middelburg (4,000) lies in the midst of mountainous country to the east of the Sneeuwberge, whose highest peak, Compassberg (7,800 feet), is mantled with snow in winter. Wheat, lucerne, citrus fruits and tobacco are grown; but stock-farming, especially the rearing of merino sheep and thoroughbred horses, is the principal industry.

Cradock (8,000), sometimes described as the capital of the Midlands, is the centre of a large irrigation district producing an abundance of wool, mohair, lucerne and fruit. With the construction of a projected railway to Tarkastad Cradock will become a still more important market centre.

Somerset East (6,000), laid out in 1825 by Lord Charles Somerset in a picturesque mountain setting, is another flourishing market town, and carries on numerous industries. The surrounding country is well irrigated, closely settled, and very productive.

THE NORTHERN KARROO. This is the largest regional division of the Cape Province but the most thinly populated, having over considerable areas less than one inhabitant to the square mile. In

climate it closely resembles the Great Karroo, the annual rainfall ranging from 7″ in the west to 15″ in the Hopetown and Colesberg districts; but owing to its greater elevation and remoteness from the sea the range of temperature, both daily and seasonally, is greater than south of the Great Escarpment. Rain falls mainly in the form of occasional summer thunderstorms, and it is exceptional for the rivers and pans shown on the map to contain water. Yet by means of 'saai-dam' irrigation along some of the river-channels connected with the Orange, and by means of furrows from the Orange itself, some degree of cultivation is possible, especially between *Prieska* and *Upington*. At present, however, the most characteristic occupation is stock-farming of the poorer kind, and in spite of the immense area of many of the farms it often becomes necessary for stock to be trekked great distances, even across the Orange River, in search of winter grazing.

A minor industry of the Northern Karroo is the manufacture of salt, usually obtained by solar evaporation from shallow dams. The district extending from *Calvinia* towards *Kimberley* is sometimes called the 'Panneveld.'

Some distance beyond Beaufort West the main line to the north sends out a branch passing through *Victoria West* (2,000) and *Carnarvon* (2,000), and terminating at *Calvinia* (2,000). It is in this region that irrigation by means of 'saai-damme' occasionally produces wonderful crops of wheat and lucerne. *Sutherland* and *Fraserburg* lie in one of the highest parts of the Northern Karroo, immediately behind the Great Escarpment, and have extremely cold winters; sheep-farming is the only industry.

De Aar (6,000) stands at the intersection of railway routes; the name, however ('the vein') does not refer to this fact, but to the presence of underground streams discovered by the first settlers in the district. The town has important railway workshops; and besides being the junction of the main lines from Cape Town and Port Elizabeth to the north, is connected with South-West Africa by a branch-line through *Britstown* (2,000) and *Prieska* (3,000). The former is the centre of an irrigated district and has grain-mills; it is also one of the principal centres of the salt industry. Prieska, on the left bank of the Orange, lies at the foot of the Doornberge; potash, asbestos and copper are worked locally, though the future of the district lies more in the direction of grain and citrus.

The Kakamas Labour Colony comprises an area of 400 square miles, some part of which is irrigated by furrows from the Orange River. The extreme fertility of the alluvial soil has encouraged the planting of citrus trees in great number; wheat also grows exceptionally well.

To the south-east of Kakamas lies *Kenhardt*, on the Hartebeeste River. The chief towns of the more easterly part of the Northern Karroo are *Naauwpoort* (a railway junction), *Colesberg*, *Hopetown*, *Richmond* and *Hanover*; stock-farming is the only occupation of importance. Four miles from Hopetown the largest bridge in the Province carries the main line across the Orange.

Bechuanaland and Griqualand West. These regions stretch from the Orange River to the Molopo. They really constitute an extension of the Northern Karroo, but have a somewhat heavier rainfall and more varied forms of plant and animal life.

Game is fairly abundant, for here the vegetation consists not merely of Karroo bush but of bush and grass. It is essentially a ranching country.

The drier western districts are inhabited by Bushmen, who live by hunting, and by wandering tribes of Hottentots, who tend cattle.

At *Upington* (3,000), the chief town of Gordonia, the Orange has been diverted so as to irrigate a large area of fertile alluvial land producing grain, citrus and lucerne. Further irrigation schemes are contemplated. It is here that the railway to South-West Africa crosses the Orange.

The eastern districts have a rainfall varying from 18 to 25 inches, but since this occurs during summer and chiefly in the form of heavy showers a great deal is lost by evaporation, leaving scarcely sufficient moisture for agriculture. Grain and fruit, however, are produced on irrigated lands along the Vaal. More important are stock-raising and dairying, although in their infancy even these industries were seriously hampered by 'lamsiekte' and other diseases.

Douglas (2,000) is the terminus of a short branch-line and has saltpans. *Griquatown* lies at the foot of the Asbestos Mountains; its chief productions are diamonds, asbestos, crocidolite and galena. *Postmasburg*, some distance to the north, has extensive deposits of manganese ore, for the transport of which a branch-line has been constructed. *Barkly West*, the oldest town in this part of the Union, is the centre of alluvial diggings which extend for 70 miles along the Vaal.

Kimberley (40,000) came into existence in 1871, within a few months of rich diamond discoveries at Colesberg Kopje, now famous in history as the Kimberley Mine. The haphazard streets of the town still follow the lines of the old mining camp. Kimberley has survived several periods of depression in the diamond industry and is now developing subsidiary industries such as engineering, the manufacture of foodstuffs, and diamond-cutting. It is of course the chief market town and cultural centre for the extensive region in which diamonds are worked.

At *Fourteen Streams*, 3 miles beyond Warrenton, the main line to the north crosses the many channels of the Vaal and then divides, one branch entering the Transvaal and the other continuing northwards through Taungs, Vryburg and Mafeking to Rhodesia. *Taungs* is the centre of a pastoral district. To the west, 80 miles from the railway, is *Kuruman*, associated with the names of Moffat and Livingstone. Near the village a remarkable perennial spring, yielding 5 million gallons daily, forms the source of the Kuruman River. The water flows for some miles and then drains away into the sand. *Vryburg* (4,000), the capital of Bechuanaland, is surrounded by ranches, some of which cover vast areas. The town is noted for its stock-fairs, and possesses a large creamery. *Mafeking* (5,000) is the headquarters of the Kimberley-Bulawayo section of the main line, and has railway workshops. It is also the centre of alluvial diggings, and is the nearest market-town to the Lichtenburg diamond fields, with which it carries on a considerable trade. It is from Mafeking that the great region to the northward is administered. The Bechuanaland Protectorate is peculiar in as much as it is administered from a town outside its own boundaries.

The North-Western Region. This region, stretching from the Olifants River northwards to the Orange, and merging eastwards into the Northern Karroo, comprises Namaqualand (a mountainous area forming part of the Damara-Namaqua Highlands), a Karroo-like tract of country to the north of *Van Rhyn's Dorp*,

Bushmanland (a region of sandy plains and barren mountains inhabited by wandering Hottentots), and the coastal plain. It is thus a region of diversified relief, but possesses a unifying characteristic, that of low rainfall. This nowhere exceeds 7″ annually, and at the coast amounts to only 2″. In normal times the region is therefore almost destitute of useful vegetation, except in the mountain kloofs and along the coast; the heavy mists of the latter area produce a fair growth of bush.

Irrigation works are in progress round *Van Rhyn's Dorp*, whilst in numerous areas there are indications of underground water that could be tapped by means of wells. At present, however, the rearing of scrub cattle and the poorer kinds of sheep and goats is the principal farm-industry. In Namaqualand natives comprise more than two-thirds of the population, the density of which, outside the small towns, is considerably less than one to the square mile.

The greater part of the north-west region suffers not only from drought, but from isolation. Since there is no railway connection between Namaqualand and other parts of the Union it is impossible for a farmer to dispose rapidly of superfluous stock when pastures threaten to become exhausted. Since pasturage in South-West Africa is often good when no rain has fallen in Namaqualand for two years, it is suggested that a railway across the Orange River would be the means of preventing the disastrous stock-losses which at present impoverish the farming population.

Until recently the chief source of wealth in Namaqualand has been copper, the principal centres being O'okiep, Concordia, Nababeep, and Springbok. These small towns are connected with *Port Nolloth*, 90 miles distant, by a steep narrow-gauge railway. By 1921 the copper output had fallen to £5,000; then, through the reopening of old workings, came new prosperity, and in 1927 the production reached the total of £165,000, one-third of the Union total. More recently, the workings have again been abandoned. It is believed, however, that the Richtersveld, occupying the great bend near the mouth of the Orange, is rich in copper, bismuth and other metals.

The most sensational event in the history of Namaqualand has been the discovery, in 1926, of a rich diamondiferous area along the coast between Port Nolloth and the Orange River, notably at Alexander Bay. The stones, which are of an unusual kind, are large and of good quality. To prevent the flooding of the market the new diamond fields have been closed to the ordinary prospector and are worked by the Government. Revenue to the extent of several millions has already been derived from this source.

The Eastern Grassland Region. The greater part of this region lies to the east of the Great Fish River, and is to be distinguished from the Cape Midlands by a heavier rainfall, varying from 20 to 30 inches annually, and by its natural vegetation, which is essentially grass. The region too has a character of its own in that it is full of reminders of the early settlers and their conflicts with the Bantu. To-day about half the population

consists of natives, not nearly so high a proportion, however, as in the Native Territories beyond the Kei. Northwards this region extends to the Orange River, and thus includes part of the South African Tableland lying beyond the Stormberge. But here the escarpment is no geographical boundary ; climate, vegetation and farm-industries are the same for example, in Queenstown and Sterkstroom, south of the Stormberge, as in the Wodehouse district to the north.

The region is more closely settled than the Cape Midlands, but owing to the character of the rainfall, which occurs mainly in the form of violent summer thunderstorms, the farmer sometimes suffers hardship. The rainfall also fluctuates considerably from year to year ; but for this reason the cultivation of maize would be an important industry. Pineapples, citrus fruits and cotton are grown in the Coast Belt, and elsewhere fruit, grain, tobacco and root-crops ; but stock-raising is the characteristic occupation throughout the region as a whole.

East London (55,000) had its origin in the early struggles of the colonists, in 1847 a fort having been constructed at the mouth of the Buffalo River (which at that time could be crossed by ox-waggon) as a means of defence against the advancing Bantu.

East London is the fourth port of the Union and the principal port of the eastern districts. Local industries include fishing, flour-milling, wool-washing, engineering, the making of boots and shoes, and fruit-canning.

The Albany district, although situated west of the lower reaches of the Fish River, belongs in every significant way not to the Midlands but to the region now being described. *Grahamstown* (15,000), founded in 1812 as a stronghold against Bantu encroachments, grew in importance with the arrival of the 1820 settlers—a refuge for the colonist flying before a savage enemy, and a rallying-point from which reprisals could be undertaken. To-day Grahamstown is a cathedral city, and one of the principal educational centres in South Africa.

Port Alfred (2,500), built around the mouth of the beautiful Kowie River, once promised to become a busy seaport, and a large sum was expended in harbour works ; the sandbar across the river-mouth, however, proved to be too great an obstacle. From Port Alfred a short line runs through Bathurst and Grahamstown and joins the Midland line at Alicedale. Bathurst, the first home of the 1820 settlers, is the centre of a district producing pineapples and citrus fruits in abundance.

From East London the main line runs north-west towards Bloemfontein, sending out several branches ; two striking westwards to form connections with the main line from Port Elizabeth, another running north-east into the Transkei, and a branch from Sterkstroom which follows the slopes of the Stormberg eastwards to Maclear. We shall take a rapid view of the towns and country traversed by these routes.

The main line climbs steadily to *Stutterheim* (2,000), 63 miles from East London. To the west lie the Amatolas, whose slopes are covered with forest and pasture. *Cathcart*, 4,000 feet above sea-level, is the centre of a thriving district producing wool, grain and deciduous fruit. From this point there is a gradual descent to *Queenstown* (14,000), once a fortified border-town, and now the market centre of an extensive sheep-farming and grain district, watered by tributaries of the Kei River. Its industries include dairying,

flour-milling and brewing. Beyond Queenstown there is a short branch-line to Tarkastad, the centre of a stock-raising district whose natural vegetation shows an interesting transition from grassveld to Karroo bush. To the north of Sterkstroom the railway crosses the Stormberg at a height of nearly 5,600 feet, and then descends somewhat to *Molteno* (2,000), once important for the coal mined in the district ; the very small quantity still worked is used only locally. From Molteno the line is continued to Stormberg Junction, whence a branch-line crosses to Rosmead, on the Midland system. *Burghersdorp* (3,000) is a quiet old-fashioned town near the Stormberg Spruit, which flows into the Orange River ; the district produces wool, grain and potatoes.

Beyond this point the line to the north divides, one branch crossing the Orange to the south of Bethulie and the other at *Aliwal North* (6,500). The latter, an important milling centre and typical border-town, carries on trade with Basutoland. Its hot sulphur springs and radio-active waters attract many visitors. 40 miles to the east is Lady Grey, a town built in a horse-shoe valley at the western extremity of the Witteberge. *Barkly East* (2,000) stands in the midst of rugged mountainous country immediately behind the ridge of the Drakensberge ; it is one of the highest towns in the Cape Province. Some distance to the south-west, and also just within the escarpment, is *Dordrecht* (3,000). Owing to their high elevation the winter climate of these districts is almost Alpine ; sheep-farming and dairying are therefore the only occupations of importance.

Skirting the southern slopes of the escarpment a branch-line from Sterkstroom to Maclear passes through *Indwe* and *Elliot*. The whole district is excellently watered by streams from the Drakensberge ; in addition to sheep-farming and dairying, fruit-cultivation is carried on.

Returning to the coast region, a branch-line from Blaney traverses a number of closely-settled districts lying to the south of the Winterberge and Amatola mountains. These mountains enrich the farm-lands with many streams, and condense so much moisture from the Indian Ocean that drought is here almost unknown. At some stations an annual rainfall of 100 inches has been recorded, although 30 inches is more typical. The region produces maize, wool, meat, tobacco, lucerne and fruit in great abundance ; whilst the Pirie forests, on the slopes of the Amatolas, yield yellowwood and sneezewood. The centre of this productive region is *King William's Town* (10,000) situated on the left bank of the Buffalo River. Its industries include milling, tanning, wool-washing, the making of furniture and wagons, and the manufacture of boots and shoes. The country immediately surrounding King William's Town is the most densely populated part of the Cape Province, outside the Cape Peninsula. As the place-names indicate, many of the settlers in the district are of German descent ; a large number of German families settled here after the Crimean War.

From King William's Town the railway continues westwards through Alice, Fort Beaufort, Adelaide and Bedford, centres of stock-raising districts. Lovedale and Fort Hare, situated just outside Alice, are important centres of native education.

The Transkeian Native Territories. There are sufficient geographical differences between the Transkeian Territories and the region west of the Kei to warrant the separation of these regions. In part the differences are climatic, for the climate of the Territories is rather like that of Natal. (At Port St. John's the mean annual rainfall is somewhat greater than in Durban ; temperatures are slightly lower.) The human factor, however, is still more important ; for although west of the Kei there is

a considerable native population, in the Transkeian Territories there are nearly a million natives and only 14,000 Europeans. The Native Territories have a modified form of self-government ; they are controlled by the Transkeian General Council, the only European members of which are magistrates.

The Territories extend from the Great Kei River to the Natal border, and cover an area of 16,000 square miles ; they include not only the district known as the Transkei, but Griqualand East, Tembuland and Pondoland.

Along the coast bush and forest occur, but elsewhere the characteristic landscape is one of rolling grass-covered plains devoid of trees. The region, again like Natal, consists of undulating country stretching from the Drakensberge to the sea ; it is traversed by numerous rivers, most of them filled with water throughout the year.

Although the Territories are not without European farmers, the white population consists largely of traders. It is in East Griqualand that the highest proportion of Europeans occurs. In 1862 Adam Kok, a modern Abraham, trekking from Griqualand West with 2,000 followers and 20,000 cattle, settled in the district of which *Kokstad* (3,500) is now the centre ; but the Griquas, in whom Hottentot blood predominated, were pastoral nomads, indolent and improvident, and within ten years most of their newly-acquired lands had been alienated to white settlers. Elsewhere the natives are mainly of the conquering Bantu race. They rear cattle, goats, sheep and pigs, and cultivate mealies and kafir-corn, particularly the former. Throughout the Territories there are over two million sheep, over a million cattle (one-third of the Cape Province total) and about a million goats. With a view to earning sufficient money for the establishment of a home, or driven sometimes by even sterner necessity, many of the young men go to work on the mines or elsewhere, usually however returning to the Territories when their object has been achieved.

This part of the Cape Province has very few railways ; indeed, communication of any kind is often difficult, owing to flooded rivers. *Umtata* (5,000) where the Transkeian General Council meets annually, is the terminus of a branch line from Amabele passing through Butterworth and Idutywa. Further north, the Natal railways send off branches to Matatiele and Kokstad. This part of East Griqualand is mountainous, and supports a large European community engaged in sheep-farming, horse-breeding, dairying, and the cultivation of grain. Port St. John's, beautifully situated near the mouth of the St. John's (Umzimvubu) River, is a holiday resort. The river, enclosed between steep banks forested down to the water's edge, is navigable for small vessels for about 12 miles, though a sand-bar renders access to the river-mouth difficult. Cotton, citrus, and sub-tropical fruits are cultivated in this part of the coastal plain.

CHAPTER XVI.

THE TRANSVAAL.

The Transvaal is a triangular-shaped block of country resting upon the Vaal and Pongola Rivers. To the north and north-west its boundary is the Limpopo, and on the east the low volcanic range known as the Lebombo. In the south-west, towards Bechuanaland, there is no natural boundary.

In spite of the fact that large areas are undeveloped, the southern part of the province is so closely settled that the Transvaal as a whole is the home of nearly one-third of the population of the Union.

An important physical feature is the Transvaal Drakensberge, which form the eastern edge of the plateau. The range reaches a well-defined northern limit in Elim Kop, 17 miles south-east of *Louis Trichardt*, in the Zoutpansberg district; in general its crests are several thousand feet lower than those of the Natal Drakensberge. Between the Lebombo Mountains and the escarpment lies the Low Veld; west of the escarpment the plateau descends northwards, and consists of High Veld, Middle Veld, and another region of Low Veld. The summits and windward slopes of the escarpment receive a heavy rainfall, amounting in some places to 80 inches annually, and are frequently shrouded in mist—hence the term 'mist-belt'; and as the Transvaal Drakensberge are composed largely of granite, a rock which weathers easily in areas of heavy rainfall and extremes of temperature, their eastern edge is highly dissected, imposing bluffs alternating with deep ravines, whilst the slopes are intersected with gullies. The evergreen forests and dense undergrowth of the mist-belt recall the South-Coast Region of the Cape.

Since the Drakensberge are essentially an escarpment and have the appearance of a mountain range only on the seaward side, they do not constitute in themselves a regional division of the Province. For the most part they belong to the High Veld region; that part of the range extending northwards from the Olifants River will be included with the Middle Veld and Limpopo Highlands, of which it forms the eastern edge.

The river system of the Transvaal is extremely interesting. The Witwatersrand, together with other ridges in the High Veld trending east and west, forms a watershed with a gentle southern slope, down which flow tributaries of the Vaal. The steeper

northern slopes are traversed by swift streams, which run in deep gorges and escape through ranges of hills by means of poorts. All these northward-flowing rivers pour their waters eventually into the Limpopo. The principal headstream of this river is the Crocodile, which rises near *Krugersdorp*. The Olifants, its longest tributary, has its source in the Bethal district. It is probable that the original source of the Olifants River was in the Drakensberge, and that the river has cut its way back through these mountains by headstream erosion. The Komati, Letaba and many other streams are engaged in the same process of creeping back, breaking up the tableland into blocks of rugged country.

The problem of the subdivision of the Transvaal into regions is one of some difficulty. Relief, climate, natural vegetation and human occupations must all be taken into account. Of these factors the most important appears to be the first, for large areas of the Province are 6,000 feet above sea level, while in others the average elevation is only 2,000 feet ; and, although climate and productions vary considerably between one region and another, these differences are largely the result of differences in altitude.

On this basis the Transvaal may be divided into the following regions :

(1) High Veld, extending across the southern part of the Province and embracing the mountainous region between the Komati and Olifants Rivers ;

(2) Middle Veld and Limpopo Highlands, together with the northern part of the escarpment ;

(3) Low Veld, occupying the north and east of the Province.

In order to put the towns of the Province into their proper divisions, the 4,000 foot contour will be taken as the boundary between High and Middle Veld, the latter being divided from the Low Veld by the 3,000 foot contour.

It may be noted that it is proposed to include with the Middle Veld those detached blocks of mountainous country in the north and northwest of the Province, known collectively as the Limpopo Highlands. On grounds of altitude alone these areas, whose elevation sometimes exceeds that of the Middle Veld, constitute a separate division—the treatment adopted in the chapter on Structure and Relief. In their climatic conditions, vegetation and occupations, however, the Middle Veld and Limpopo Highlands have so much in common that they form a single regional division.

It must also be understood that the transition between High and Middle Veld is not sudden, but is marked by gentle grass-covered slopes, dipping northwards, and by terraces held up by lines of low hills running east and west. These slopes and terraces, sometimes known as ' banken,' are crossed by numerous streams which tumble down to the lower country, often cutting their way

through the low ranges of hills, and affording many examples of fine river-scenery. The descent from the Drakensberge to the Low Veld of the Eastern Transvaal shows much the same type of country.

So considerable is the influence of the gold-mining industry in the Southern Transvaal that it might be supposed that this factor is the greater characteristic and altitude the lesser. It must not be forgotten, however, that the industry occupies only a small part of the High Veld region, a large part of whose population is engaged in stock-farming and agriculture, industries dependent directly upon relief and climate. Nor is it possible to isolate the gold-mining districts from the rest of the High Veld. They are scattered about over a wide area, and even within our own times their centre of gravity is changing. For these reasons it is maintained that the most significant aspects of the Southern Transvaal are its high elevation, its invigorating climate, and the productiveness of its pastures and cultivated lands. The mining industry, though temporarily an important feature, is not the essential characteristic.

The climate of the Transvaal, especially on the High Veld, is marked by great seasonal and diurnal variations of temperature, and by a rainfall confined mainly to the summer months. (Observations at Vereeniging show an average daily range of 31°, whilst 88% of the rainfall occurs between October and March). Since rain falls mainly in the form of thundershowers, storage works have been constructed in certain areas to conserve and regularize the supply of water for agricultural purposes. On the whole, however, there is much less necessity for irrigation than in the Cape Province.

In general the Province is extremely productive and is developing rapidly. Half the tobacco crop of the Union, nearly half the cotton crop, and nearly one-third of the maize crop come from the Transvaal. A significant feature is the small number of sheep, of which the Province has only one-ninth of the Union total. The Middle and Low Veld are too warm for sheep to thrive, and, moreover, are covered largely with bush, whereas the High Veld pastures are usually sufficiently good for cattle-raising, a more profitable industry. In mineral wealth the Transvaal far surpasses the other provinces.

The High Veld. With the exception of a small part of the Vaal Valley and that of its tributary, the Harts, and excepting also a narrow strip of country between Swaziland and Zululand, the whole of the Southern Transvaal exceeds 4,000 feet in elevation and may therefore be called High Veld. Northwards the 4,000 foot contour crosses the Province beyond *Pretoria*, and embraces the highland region to the south of the Olifants River.

The High Veld consists typically of gently-undulating grass-covered plains, and although crests and hollows occur there is a marked absence of actual hills and valleys, except eastwards towards the Drakensberge and along the northern margin. The watershed described earlier in the chapter consists of a series of ridges extending from the western boundary through *Johannesburg* as far as *Ermelo*; the Witwatersrand, so named because of its silver streams, is one of these ridges.

Indigenous trees are absent from the High Veld, but mimosas and willows grow along the river-banks, and pines, gum-trees, wattles and poplars are planted as wind-breaks for orchards and grown in plantations for various industrial purposes.

The rainfall of the High Veld varies from 17 inches in the west of the Province to an average of 40 or 50 inches in the Drakensberge (e.g., *Schweizer Reneke* 17″, *Lichtenburg* 21″, *Krugersdorp* 23″, *Pretoria* 30″, *Piet Retief* 37″, *Lydenburg* 40″). The south-western districts, although deficient in rainfall and less closely settled than the central and eastern regions, nevertheless hold an immense quantity of underground water, which issues in the form of springs forming the sources of the Marico and other headwaters of the Limpopo. Other streams, like the Harts, Klip and Mooi, flow southward to the Vaal. The strata are here composed of porous limestone, traversed by a labyrinth of underground channels into which, the run-off being small in this region, the rainwater percolates. The limestone area covers over 2,000 square miles, and, when one estimates that the average rainfall over such an extent of country amounts to five hundred thousand million gallons annually, it will be realized that the region, although unproductive compared with the eastern districts of the High Veld, contributes very materially to the flow of water to the Vaal and the Limpopo. Limestone beds also occur elsewhere in the Southern Transvaal, many of the Rand towns obtaining their water supply from bore-holes which tap these underground reservoirs.

The grasslands of the High Veld are well suited to stock-raising and dairy-farming, which are most important in the areas immediately north of the Vaal. *Ermelo*, *Standerton* and *Wakkerstroom* are the chief districts for horse-breeding and sheep-farming, while Angora goats are most numerous in the *Bloemhof* district. Pig-rearing and poultry-farming are also widespread industries. Many High Veld farmers own land in the Low Veld or in Natal, to which they trek their stock in winter.

The chief product of cultivation is maize; barley and oats are also grown, largely as fodder crops to supplement winter grazing. In the district extending from Pretoria to Lydenburg wheat is cultivated. Owing to frosts tobacco-growing is restricted to the

region of least elevation, e.g., the districts of *Piet Retief*, *Pretoria*, and *Marico*, and the northern slopes of the Magaliesberge. Climatic conditions suit the cultivation of citrus and deciduous fruits, especially the latter, which compete successfully in the European market with those grown in the Cape Province. Hailstorms, however, are a serious handicap to the fruit-farmer.

The principal source of wealth in the High Veld is the gold-mining industry. Up to the present gold to the value of over a thousand millions sterling has been taken from the mines, and it is believed that an equal amount still remains to be mined. But while production on the East Rand, extending from *Boksburg* to *Springs* and *Daggafontein*, will continue perhaps another quarter of a century, the mines of the Central Rand will probably be idle in a few years' time. The gold industry provides a profitable market for the farmer and manufacturer. Every year the total amount spent by the industry in the purchase of South African industrial and farm products exceeds eight millions sterling.

The High Veld has other forms of mineral wealth. Diamonds are obtained from the Premier Mine, near Pretoria, from river-diggings along the Vaal between Bloemhof and Christiana, and more recently from the Lichtenburg alluvial fields. The region extending eastwards from Johannesburg for over 100 miles is dotted with collieries; iron-ore of high grade is worked near Pretoria; whilst in the eastern districts asbestos, alluvial tin, and numerous other minerals occur.

The administrative centre of the goldfields is Johannesburg, with a population of 383,000; rather more than half the number are Europeans. In Johannesburg climate and economic conditions conspire to produce an atmosphere of restless vitality unusual in South Africa, and the story of the city's development from a rough mining camp to its present position as the largest city in the Union, with a university, a cathedral, an observatory, and 700 miles of busy streets and tree-lined avenues, is one of the romances of modern history. Nor is Johannesburg, like Kimberley, almost entirely dependent upon a single industry, for, while many of its activities go to satisfy a large part of the local demand for mining stores, implements, and machinery, the city is also the business capital of widely-scattered farming and industrial communities, and carries on the manufacture of a great variety of food products. Other industries are the making of chemicals, scientific instruments, furniture, wire cables, clothing, leather goods, bioscope films, paper, cement and earthenware, and agricultural implements.

On the West Rand the principal gold towns are *Krugersdorp* (34,000) and *Roodepoort-Maraisburg* (25,000). Their population has somewhat declined with the closing down of certain mines in this area.

Germiston (53,000), nine miles from Johannesburg, is the point of intersection of the principal railway routes of the Southern Transvaal, and carries on gold-refining, engineering and chemical industries.

The East Rand, reputed to be the richest gold-producing area in the world, comprises the towns of *Springs* (40,000), *Benoni* (52,000), *Boksburg* (38,000) and *Brakpan* (38,000). The last-named has a power-station and large engineering works.

The chief town of the south-western districts is *Potchefstroom* (15,000), the oldest town in the Transvaal and once its capital. The surrounding district, irrigated by water drawn from the Mooi River, is one of the most important cattle areas in South Africa, and produces also fruit, tobacco, cereals and fodder crops. The town itself is quiet and beautiful, with furrows running through its shady willow-lined streets.

To the south-west lie *Klerksdorp* (6,000), *Wolmaranstad*, *Bloemhof* (3,500) and *Christiana*, all linked up by the main line from Fourteen Streams. The numerous short tributaries of the Vaal serve also to irrigate this region. The valley-lands yield alluvial diamonds, which are mined also near *Schweizer Reneke* on the Harts River.

A branch-line from Krugersdorp runs through the market town of *Ventersdorp* to *Lichtenburg* (5,000), recently the scene of further diamond discoveries.

Zeerust (3,000) stands in the valley of the Marico, whose irrigated lands produce citrus fruits and tobacco. Zinc, lead and fluorspar are mined in the district. At *Ottoshoop*, on the line to Mafeking, there are goldfields, but owing to difficulties with underground water the output is small.

Pretoria (84,000) is built on the northern slopes of the High Veld, but since the altitude is 1,300 feet lower than that of Johannesburg the temperature is somewhat warmer. The town occupies the valley of the Aapies River, and is pleasantly situated amidst green hills, on one of which, overlooking the town, stand the Union Government Buildings. The capital of the Transvaal and the administrative capital of the Union, Pretoria is also developing industrially, and has iron and steel works, railway workshops, tanning and shoe factories, cement works, oil refineries and printing works, and a branch of the Royal Mint. Twenty-two miles distant is the Premier Diamond Mine, whilst towards Rustenburg stretch fertile lands irrigated by water from the Hartebeestpoort Dam. Pretoria is also an important railway junction ; it stands upon the main line to the north, which sends out branches west and east linking up with Mafeking and Delagoa Bay.

The chief towns to the south of Johannesburg are *Heidelberg* (3,500) and *Vereeniging* (7,500). The former is a farming centre and market town. Vereeniging, on the Vaal, has coal-mines, iron and steel works, flour mills, pottery works, and a large electric power station. Over four million trees have been planted in the district, yielding hardwoods for the making of railway sleepers, wagons and furniture. The Vaal River Barrage, twenty-five miles downstream, provides the Rand Water Board with 20 million gallons of water daily, besides providing for local irrigation works. From Vereeniging water for the use of the mines and towns on the reef is pumped to Swartkoppies, the distributing centre.

Standerton (4,000), *Volksrust* (3,500), *Wakkerstroom* (3,500), and *Piet Retief* (2,000) are the principal farming centres of the South-Eastern Transvaal. In this region scarcely any minerals are worked, but in a rural sense the district is closely settled, carrying on pastoral industries and crop farming under the best conditions. Piet Retief, one of the gateways into Swaziland, has poplar plantations for the making of matches, and is noted for tobacco.

To the north of these towns lies the coal-mining region, whose principal centres are *Witbank* (11,000), *Middelburg* (6,000), *Belfast* (2,000), *Ermelo* (5,000), and *Carolina* (2,000). Witbank has one of the largest electric power stations in the world. The whole of the coalfield is highly mineralized : iron, copper, platinum, cobalt, graphite, tin, galena and asbestos are worked here and there. Stock-farming and agriculture are also carried on extensively, and around Middelburg there is much afforestation. *Bethal* is the centre of the most thickly populated rural district in the Union ; maize and potatoes are the chief crops.

Many of the colliery towns stand upon the Delagoa Bay Railway, by means of which coal is sent down to the coast. *Waterval Boven*, on the same line, has railway workshops. To the north *Lydenburg* (2,000), reached by a branch-line from Belfast, stands in the valley of the Spekboom River, a tributary of the Olifants, and is surrounded by the highest land in the Transvaal. The upland pastures afford grazing for sheep, while barley, wheat, tobacco, and fruit are grown in the valley. Asbestos of unusually long fibre is mined locally. Both Lydenburg and Pilgrim's Rest are centres of alluvial gold-fields which, since their discovery in 1869, have yielded gold to the value of a million sterling.

Photo.] [*S.A.R. Publicity Department.*

SPEKBOOM VALLEY, LYDENBURG.

THE MIDDLE VELD AND LIMPOPO HIGHLANDS. As the name implies, the Middle Veld is intermediate in elevation between the High Veld and the Low; in general its altitude varies from 3,000 to 4,000 feet, although parts of the Limpopo Highlands exceed this elevation. Owing to the lower altitude the Middle Veld is warmer than the High Veld.

The rainfall varies from 20 inches in the west to over 50 inches in the Eastern Highlands, differences between one place and another sometimes being due to local configuration (e.g., *Pietersburg* 22″, *Rustenburg* 26″, *Louis Trichardt* 32″, *Potgietersrust* 34″). On account of this variation and owing also to differences of soil, the vegetation of the Middle Veld includes both bush and grass, the former predominating. Thus the region is sometimes known

as the High Bushveld, as distinct from the Low Bushveld along the Limpopo Valley. Thorn-trees and euphorbias are common. The principal grass-covered regions are the *Springbok Flats*, a remarkably level plain occupying the centre of the Province, and the *Waterberg* and *Pietersburg Highlands*. The vegetation of the Zoutpansberg district is bush, like that of the Low Veld ; baboons, jackals and wild cats are numerous in this region, and lions are not infrequently a nuisance. Those parts of the North-Eastern Highlands which face the Indian Ocean are mantled with forests of evergreen trees, from which acacias and thorn-trees are almost entirely absent.

With the exception of the Pietersburg district, which is as closely settled as most of the rural districts of the High Veld, the Middle Veld and Limpopo Highlands are regions of sparse population. In the Waterberg district (which, however, comprises a small area of Low Veld), there are only six persons to each square mile ; of this number five are natives. Since the region as a whole is not unhealthy, and has a rainfall that permits of stock-raising and crop-farming being carried on without difficulty, it is capable of more intensive development. At present the chief farm-industries are the raising of cattle and the cultivation of citrus fruits, tobacco, cotton, ground-nuts, wheat, pineapples, maize, kafir-corn and fodder-crops. In some areas cattle-raising is difficult owing to the presence of poisonous plants and to the prevalence of East Coast fever. Horses are also subject to sickness in summer, and for transport mules and donkeys are commonly employed. Agriculturally the most important part of the Middle Veld is the extremely fertile *Rustenburg* district, which produces half the cotton grown in the Transvaal and three-fifths of the tobacco. In the production of maize the Rustenburg and Waterberg districts are both important. The Springbok Flats are deeply covered with fertile soil, but, lying to the west of the Drakensberge, have a somewhat deficient rainfall. Bore-holes, however, afford a good yield, for the region is almost completely encircled by higher country.

Most of the towns of the Middle Veld and Limpopo Highlands are connected by a railway running from Pretoria northwards to Messina. *Rustenburg* (6,000), surrounded by citrus orchards and plantations of tobacco and cotton, is reached by a branch line from Pretoria North. The district is well-watered by streams from the Magaliesberge that drain northwards into the Limpopo. Rustenburg has tobacco factories and a cotton ginnery.

At *Warmbaths*, on the main line, there are mineral springs. *Rooiberg* and *Leeuwpoort* are centres of tin-mining districts.

Nylstroom (1,000) is one of the oldest settlements in the Transvaal. The stream flowing past the town was so named because the early colonists, pushing ever northwards, thought they had reached the source of the Nile. According to tradition, they constructed a boat, and, following the river, eventually found themselves in Delagoa Bay.

The railway now turns north-west, and traverses a part of the Waterberg district in which platinum has recently been worked. From Naboomspruit a branch-line has been constructed to Zebediela, the centre of immense citrus estates. *Potgietersrust* (2,500), with its warm climate and good rainfall, is the centre of a prosperous irrigation district producing tobacco, cotton, ground-nuts and oranges. From this point the line climbs to *Pietersburg* (7,000), the largest town of the Northern Transvaal and until 1911 the terminus of the railway. Here again there are citrus estates, cotton plantations, and fields of mealies and kafir-corn, as well as deciduous fruit orchards and pasture-lands. To the east of Pietersburg the Limpopo Highlands are met by the Drakensberge, which here curve to the west. Considerable erosion as the result of the heavy rainfall in this area has exposed numerous minerals, of which asbestos, tin and corundum are most important. From the crests of this part of the Drakensberge there is a beautiful and imposing panorama of valley and woodland sloping steeply down to the Low Veld.

Louis Trichardt (2,500) is the chief town of the Zoutpansberg district, a sparsely-settled region with only four Europeans to every ten square miles. The wooded glens of the Zoutpansberge form a background to the town.

The Low Veld. This regional division comprises the 'Low Country' which lies between the escarpment and the Lebombo Mountains, and in the north along the Limpopo valley. The maximum elevation is about 3,000 feet, but in some of the river valleys the altitude is little more than 600 feet. The region is traversed by numerous streams flowing into the Limpopo. Many of these streams flow perennially, although their volume towards the end of winter is greatly diminished.

The northern region has a rainfall of only 15 inches, but parts of the low country to the east of the escarpment receive twice that amount. The landscape is park-like in appearance, the vegetation consisting of tall grasses, bush, and scattered trees. It is believed that the grass could be used for paper-making, but the trees are for the most part stunted and twisted and therefore of little utility. Baobab (cream of tartar) trees are numerous along the Limpopo, whose banks are well-wooded and sometimes very beautiful. The region, however, is not entirely clothed with vegetation; in the drier areas vast expanses are semi-desert in character and consist of barren stony ground. Lions and other game are plentiful, and in order to check the eradication of natural fauna certain animals are allowed to live unmolested in the Sabie and Shingwedzi Game Reserves, now merged into one continuous area known as the *Kruger National Park*.

Owing to the prevalence of malaria the European population is small. The natives tend flocks of goats and Cape sheep, but horse-sickness and East Coast fever make the rearing of horses and cattle very difficult. The low country contains a variety of fertile soils, and in certain districts maize, cotton, sugar-cane, citrus and sub-tropical fruit, tomatoes, ground-nuts and sweet potatoes are successfully cultivated. The total agricultural output, however, is small.

The Low Veld has only two railways. The south-eastern area, which is the most closely-settled part of the low country, is traversed by the Johannesburg-Delagoa Bay line. *Komati Poort* is a small border town and railway junction. *Barberton* (2,000), reached by a branch line from *Kaapmuiden*, stands in the shadow of a great spur of the Drakensberge. The town came into existence with the discovery of alluvial gold in the Kaap valley, half a century ago ; the oldest producing mines in the Union occur in the neighbourhood. Asbestos, nickel and talc are also worked. Barberton is a healthy town, malaria having been driven away ; and, although the district is not so flourishing as in the early days of the gold rush, agricultural development is proceeding rapidly. Some thousands of acres are under irrigation. Eastwards there is ranching country watered by the Komati and Lomati rivers.

Another railway, connecting Komati Poort with Messina, traverses the Low Country Gold Fields, comprising the Murchison Range, the Selati River, the Woodbush and the Klein Letaba fields. The amount of gold known to exist in this area is considerable, but the ore contains antimony, which is not easily separated from the gold. At present the ore crushed annually amounts to only a few thousand tons. *Mica* and *Corundum*, near the Olifants River, derive their names from minerals worked locally. At *Gravelotte*, also on the railway, there has been considerable enterprise in agriculture and ranching. *Leydsdorp* was at one time the chief town of the Low Country, but its goldfields are believed to be worked out and the population has declined. Here again, however, we find the pioneer farmer. Beyond Gravelotte the line crosses the Murchison Range to *Tzaneen*, lying in a well-cultivated valley ; it then traverses part of the Limpopo Highlands, descending beyond the Zoutpansberge to *Waterpoort*, a cattle market and agricultural centre standing in the midst of the fertile valley of the Sand River. *Messina*, eight miles from the Limpopo, is the centre of the most productive copper mines in the Union. Coal having been found at Rotterdam, ten miles distant by railway, smelting works have recently been erected. Some ranching is carried on, but the soil is usually too shallow and stony for agriculture. In 1929 the railway was extended to Beitbridge on the Rhodesian side of the Limpopo.

CHAPTER XVII.

THE ORANGE FREE STATE.

The Orange Free State consists of an elevated plain, from four to five thousand feet above sea-level, sloping westwards and north-westwards to the Vaal.

The Vaal, Orange and Caledon Rivers, and in the north-east the Drakensberge, form natural boundaries. Part of the western frontier, however, is quite arbitrary.

Except in the Eastern districts, which are undulating and sometimes distinctly mountainous, the surface of the province is remarkably level; only an occasional koppie, or a line of low hills, relieves the general flatness. Grass, and in the south-west Karroo bush, is the dominant vegetation, though trees are found near streams and farms.

In the hilly country bordering upon Basutoland the Modder, Riet, Vet, Zand, Valsch and other rivers have their source; they all flow westwards, and in the summer empty their swollen brown waters into the Vaal. Further north the Klip and Wilge, also tributaries of the Vaal, rise in the main Drakensberge range. Many of these streams are utilized for irrigation.

Farmers in this province have to contend with unseasonable frosts and long periods of drought. They are often dependent upon boreholes to provide water for the farmhouse and for livestock during the dry season. Many farmers are obliged, moreover, to trek stock during the dry season to warmer and better-watered regions such as Natal and the Eastern Transvaal.

The Orange Free State is without great mineral wealth, though diamonds and coal are found. Thus the population is predominantly pastoral and agricultural; most of the towns have come into existence as markets for the produce of these industries. Other towns, such as *Parys*, were originally religious centres. The position of many of the towns along the eastern border has been determined by strategic considerations. Such towns occupy situations which could easily be defended, whilst usually they possess that degree of 'nodality' which would permit the quick concentration of the defending forces to withstand a Basuto attack.

Regional Divisions.

The Orange Free State is small and compact, and there are no great geographical differences between one area and another; yet there is a sufficiently marked contrast between east and west to warrant a subdivision of the province into two regions. This subdivision should not be based upon altitude; the difference is in respect of rainfall, and the occupational differences to which this factor gives rise. A convenient boundary between the two regions may be found in the 20″ isohyet, which traverses the province from north to south, passing west of *Bloemfontein*.

The Eastern Region. This half of the province has an average rainfall of at least 20″ (cf. *Ficksburg* 31″, *Harrismith* 28″, *Smithfield* 25″, *Bloemfontein* 21″), and is the home of fairly prosperous farming communities. It is a closely-settled area, with good railway communications. Natural conditions favour stock-farming, dairying and horse-breeding. Creameries and cheese factories are numerous. Heavy crops of maize are produced, especially in the north-eastern corner of the province, where grain-elevators are frequently to be seen. In many districts afforestation has been extensively practised. Along the Caledon valley, upon lands enriched by soil washed down from the mountains, good crops of wheat are obtained. Fodder crops are grown in abundance, and find a ready market in the drier western region. It is also common for farmers in this area to purchase and fatten for the market stock animals reared in the drier districts, and as cattle bred for beef increase in numbers in the future a trade similar to that practised in the U.S.A. between the western ranches and the corn belt will develop greatly. Deciduous fruits are widely cultivated, especially in the north. This industry is assisted by cold winter frosts, which tend to keep down insect-pests.

Bloemfontein (55,000), the Free State capital, is a market town and the seat of government. It is to-day a flourishing and progressive city, the judicial capital of South Africa, and a religious, cultural, and educational centre. Engineering, milling, wagon-making and other industries are carried on, whilst as an important junction and railway centre the city possesses large engine and repair shops. Over a million trees have been planted in and around the town.

From Bloemfontein a line runs eastwards past Thaba Nchu to Ladybrand, and thence northward to Ficksburg, Bethlehem, and Frankfort. The number of branch railways throughout these north-eastern districts is at once the cause and the result of their evident prosperity. *Ladybrand* (5,000), one of the most beautiful towns in the Orange Free State, is very near the Basuto border, and commands a fine view of the Maluti mountains. Its grain-mills are driven by water-power. Maize, wheat, rye and dairy-produce are the chief products of the district. *Ficksburg* (4,000), another important gateway into Basutoland, stands on the Caledon River, and is surrounded by one of the most fertile stretches of country in the province; and since the soil contains natural phosphates good wheat is grown. *Bethlehem* (9,000) is a

railway centre and has railway workshops, besides flour mills and creameries. The rich farm-lands of the district are especially noted for grain, fruit and dairy-produce, and for the rearing of pedigree sheep. *Frankfort* (3,000) stands in the fertile valley of the well-named Wilge River, and derives hydro-electric power from a waterfall near the town. Stock-farming, horse-breeding, and the cultivation of maize are the principal farm occupations. *Harrismith* (7,000), also on the Wilge River, commands several passes across the Drakensberge, notably that which carries the railway from Bethlehem over the escarpment and down to the plains of Natal, two thousand feet below. For a considerable period Harrismith was an outpost of European settlement, a protective centre for the pioneer farmers, and the principal gateway between the coast settlements and the interior. Grain, butter, wool, mohair, meat and hides are among the principal productions. Besides several creameries, the town has large woollen mills covering six acres. *Vrede* (3,000), some sixty miles to the north, is especially important for horse-breeding. The district derives great advantage from a branch-line connecting this part of the province with the main Natal-Transvaal route.

Kroonstad (14,000), the second town of the Orange Free State, stands on the Valsch River, which at this point is wide and deep. It is an important railway junction and coaling centre, coal being mined in the district. Milling, dairying, and the making of wagons, furniture, and leather are important industries.

Parys (4,000), on the south bank of the Vaal, is one of the oldest irrigation settlements in the province. The river is here about a thousand yards wide, and surrounds numerous green islands of great size; on one of them a golf-course has been laid out. Most of the boats used by Transvaal and Orange Free State boating-clubs are made at Parys. Other industries include basket-making, dairying, milling, jam-making and the preparation of tobacco. Extensive tree-planting has enhanced the natural beauty of the town and its surroundings. *Heilbron* (3,000) is the centre of an especially productive area in which stock-raising, dairying, and the cultivation of maize and fruit are the staple occupations.

The south-eastern corner of the province is not so closely settled as the regions just described. Both agriculture and stock-raising are carried on, but owing to 'rain-shadow' conditions the latter industry predominates. A railway which crosses the Orange at Aliwal North traverses these south-eastern districts and terminates at Bloemfontein. *Rouxville*, *Zastron*, *Wepener*, and *Dewetsdorp* lie along this route. Some of these are border-towns carrying on a considerable trade with Basutoland. *Bethulie*, a busy little market town near the Orange River, benefits by the fact that it stands upon the East London-Springfontein railway route.

The Western Region. In this region of deficient and irregular rainfall (e.g. *Philippolis* 18″, *Springfontein* 17″, *Fauresmith* 14″) the predominant industries are pastoral; sheep-farms covering over a thousand morgen are not uncommon. The sheep are generally of an inferior kind, reared more for their mutton than for wool. The rivers are too deeply trenched, and their flow is not sufficiently constant, to permit of irrigation, but agriculture is carried on here and there by 'dry-farming' methods. In the south-west corner of the province the replacement of the original grassveld by Karroo bush is said to be the result of veld-burning and overstocking. The population is comparatively scanty; there are only a few small towns, and these are for the most part

without railway communications. Fresh discoveries of alluvial diamonds along the Vaal, however, bring temporary prosperity to settlements in this area.

The principal towns of the western region are *Jagersfontein* (4,000), *Koffiefontein* (3,000), *Fauresmith* (2,000), *Philippolis*, *Edenburg*, *Bethulie*, *Springfontein*, *Brandfort*, *Boshof* and *Theunissen*. The first two have diamond mines; what is considered to be the most perfect diamond ever discovered came from Jagersfontein. The remainder of those enumerated are small market towns standing in the midst of pastoral districts. Springfontein is the junction of the two great trunk routes from Port Elizabeth and East London, and also sends off a branch to Kimberley. Philippolis, the oldest town in the Orange Free State, carries on wool-weaving, and has a school where the spinning, weaving and dyeing of wool are taught. Edenburg, Brandfort and Theunissen have the advantage of being situated on the main line to the north; they accordingly send poultry and other produce to the Johannesburg market.

CHAPTER XVIII.

NATAL.

Natal is the best-watered province of the Union. The lofty Drakensberge obstruct the moist winds from the warm Indian Ocean so effectively that in Natal alone there are over a hundred rivers. The rich panorama of meadow, orchard, woodland, plantation and bamboo-grove along the valleys of these streams and in the coast region has caused Natal to be known as the Garden Province. Another charm of the Natal landscape is its undulating character; even the Coastal Plain is diversified with hills and the deep valleys of innumerable streams, filled with water right up to their wooded banks.

The principal rivers of the province are the Tugela, the Umfolozi, the Umkomaas, the Umzimkulu, the Umgeni, the Umkuzi and the Pongola. Of these the first is the longest and most important; its headstream is a scenic wonder of world interest. Rising in that amphitheatre of lofty serrated summits known as Mont-aux-Sources, the Tugela plunges down a cliff more than two thousand feet in height, and enters a narrow chasm whose steep rock-walls rise in places thousands of feet above the stream. Emerging from this cleft, the Tugela enters upon its two-hundred-mile journey to the Indian Ocean; in its course it is joined by the Mooi, Buffalo, and other tributaries. For some distance the Pongola River marks the boundary between Natal and the Transvaal, but the lower part of its course is in Portuguese territory. The rivers of Natal are navigable only for short distances, but are useful as a natural means of irrigation.

The productiveness of Natal is reflected in the density of its population. Natives constitute about 80% of the total; from the old régime of tribal wars, cattle raids, and conflict with white settlers they have at last emerged upon a peaceful plane of existence, and live by stock-raising and agriculture. They are concentrated mainly in Zululand, where native modes of life still prevail, authority residing in hereditary chiefs and in the paramount Union Government. Europeans form less than one-tenth of the Natal population; they are even outnumbered by the Asiatics, originally introduced as indentured labourers for the cane-fields and tea plantations.

The province may be divided into four regions, differing one from another not so much in regard to altitude, but with respect to rainfall and temperature, and the resultant differences in occupations. In Northern Natal, however, the principal geographical factor is the presence of coal and iron.

1. The Coast Lowlands. This region is a northern extension of the coastal plain of the Cape Province. Only about 10 miles wide in the south, it broadens out northwards, and in Zululand attains a width of 50 miles. The subtropical conditions characteristic of the coast also extend for some distance up the valleys of the numerous streams that cross the coastal plain.

The warm Mozambique current, over which the south-east and east winds pass, helps to make the coast lowlands hot and moist; over forty inches of rain falls annually throughout the region, and since part of this precipitation occurs in winter the growth of dense bush and forest is encouraged. Indeed, natural vegetation is here of almost tropical luxuriance: waving palms, gracefully-bending bamboos, trees in flower, ferns and creepers in endless variety greet the eye; the scented air is filled with the shrill notes of birds, and the chattering of monkeys.

Natural conditions of this kind still persist in the extreme south of the province, and in Zululand; but the middle portion of the coast belt is intensively cultivated. Sugar, tea, tobacco and a variety of sub-tropical fruits are the chief products; but cotton, millet, hemp, maize, beans and wattle are also obtained. Generally speaking, climatic conditions are unsuited to stock-raising. Papyrus grass is grown along the lower reaches of the Umfolozi River, and is made into paper-pulp, whilst rubber trees have been planted in parts of the Pongola valley.

Apart from Durban, the coast region has no large towns, but is nevertheless densely populated. Tea factories, sugar mills and cigar factories are numerous. A large proportion of the inhabitants are Indians, many of whom are now 'free,' and cultivate market-gardens.

A railway traverses the length of the coastal plain, from Port Shepstone in the south to *Pongola* on the Transvaal border. The construction of this line was expensive and difficult, owing to the numerous rivers which had to be bridged; such a railway was an economic necessity, however, in view of the absence of natural harbours along the coast. The waves and currents of this part of the Indian Ocean cause sand-bars to form across the mouths of rivers, whose waters often spread out to form lagoons, connected with the sea only by narrow and shifting channels. Hence a harbour has been created at *Durban*, to which port the railway brings the entire trade of the coast lowlands.

Geographically, Durban owes its origin to a landlocked bay, eight square miles in area but only a few feet in depth, formerly called Port Natal. Besides having a very large trade, Durban is an important coaling-station and the chief whaling centre of the Union; whilst under the stimulus of its large population (estimated in 1931 to be 150,000) many industries have sprung up, represented by sugar-refineries, breweries, jam, biscuit, match and soap factories, and flour mills. Moreover its genial climate, alluring scenery and social amenities make Durban one of the most popular holiday-resorts in

Photo.] [*S.A.R. Publicity Department.*

DURBAN HARBOUR.

South Africa. It is the third city and chief port of the Union. *Port Shepstone* is built at the mouth of the Umzimkulu river; many varities of limestone and marble are quarried near the town. The port formerly handled a few thousand tons annually, products of the coastal plain, but this trade is declining. *Stanger*, *Verulam*, *Kearsney* and *Isipingo* are important centres of sugar and tea cultivation. *Umbogintwini* has a large factory where chemicals and explosives are made.

2. THE MIDLANDS. This is a region of such diversified elevation that the term 'terrace' can hardly be applied to it (cf. Eshowe 1,800 feet; Pietermaritzburg 2,218 feet; Greytown 3,581 feet; Richmond 2,816 feet; Harding 3,500 feet). Hence a delimitation of the region should be based not upon altitude, but upon climate, vegetation and occupations.

The physical characteristics that distinguish the Midlands from the Coast Lowlands are as follows :

(a) Higher elevation, resulting in a lower mean annual temperature; (b) a somewhat lower rainfall, confined, moreover, almost entirely to the summer months ; (c) a comparatively infertile soil, mostly of shale origin ; (d) vegetation of a park-like character, consisting of grass and meadow land with scattered trees and bush.

As a result of these natural conditions the Midland Region yields cultivated crops such as maize, barley, millet, tobacco and lucerne, together with a small quantity of cotton ; but as an agricultural area it is much less productive than the coast belt. This inferiority is due mainly to poverty of soil and to the hilly nature of the country. The most valuable product of cultivation is the black wattle, which thrives in soil unsuited to ordinary agriculture. Natal now has 220,000 acres of wattle plantations, concentrated mainly in the Midlands. Stock-raising and dairying are carried on, although handicapped by East Coast fever.

The chief town of the Midlands, and also the capital of the province, is *Pietermaritzburg* (45,000), a clean, well-built city, picturesquely situated in a setting of green hills. Maritzburg is not only the agricultural centre of the Midlands, but one of the principal industrial cities of Natal, with railway workshops, flour-mills, boot factories, tanneries, and factories where wattle extract is made. Maritzburg is also a notable railway centre, and is the terminus of a line from East Griqualand. *Eshowe*, originally a mission station, became in time the capital of Zululand, which in 1897 was incorporated with Natal. Close to the town is a forest, reserved as a natural park, containing an immense variety of antelope, birds and monkeys. Other small towns in this somewhat sparsely populated Midland region are *Greytown*, *Krantzkop*, *Richmond* and *Harding*. The cascades and forests of *Howick* attract many holiday visitors. Near at hand are the remarkable Howick Falls, where the Umgeni River makes a great leap down a perpendicular cliff twice the height of Niagara ; the falls are utilised in the making of electricity.

3. The Western Pastoral Region. Like the Natal Midlands, this region (quite apart from the Drakensberge slopes) is also remarkable for great differences in elevation (cf. Colenso 3,156 feet, Ladysmith 3,284 feet, Mooi River 4,500 feet, Bulwer 5,100 feet) ; its essential unity as a regional division arises from a lower temperature and rainfall, grassland vegetation (diversified only by patches of thornbush), and the predominance of stock-farming and dairying.

Except in river valleys and in the kloofs of the Drakensberge, the region is naturally treeless, but affords splendid grazing ground for cattle, horses and sheep. Many landowners sell ' winter grazing ' to farmers who trek their flocks and herds from the Orange Free State during the dry season. Pig-rearing, associated with the production of fruit and grain (as in the south-western districts of the Cape) is a wide-spread industry ; there are numerous butter, cheese and bacon factories throughout the region.

Ladysmith (7,000) is the centre of a rich pastoral and agricultural district. For many years it was the terminus of the line from Durban, and therefore handled goods conveyed by road to and from the north. It is now important as the junction for the railway crossing Van Reenen's Pass into the Orange Free State, and has large railway workshops. *Estcourt* (2,000) is well known for its fine bracing climate and hill scenery ; several bacon and cheese factories give evidence of the farming pursuits carried on locally. *Mooi River* stands upon a spur of the Drakensberge ; thirty miles to the west, behind range upon range of foothills, Giant's Castle and Cathkin Peak lift themselves to the sky. The intervening country is wild and scarcely inhabited, and is swept in summer by severe thunderstorms of a most destructive character. In former days Bushmen, outlawed from the plains by the conquering Zulus, made these eastern mountain slopes their stronghold, and lived by raiding the herds of white settlers and Bantu alike. Numerous rock-paintings remind us of their occupation of these mountain fastnesses.

The upper part of the Tugela basin contains many memorials of episodes in South African history. The battle fields of Elandslaagte, Colenso, Spion Kop and Nicholson's Nek, all pivoting around the beleaguered town of Ladysmith, commemorate the resistance offered by the Boers in 1899 to General Buller's northward advance. *Weenen*, a flourishing irrigation district, produces grain, root-crops, tobacco and fruit, and formerly carried on ostrich farming ; the name (' weeping ') commemorates the six hundred men, women and children massacred by Dingaan's impis during the night of February 17th, 1838. The recently electrified main line between Maritzburg and Glencoe is dependent on the great power station at *Colenso*, to which fuel from the northern coalfield can be cheaply transported.

4. The Northern Industrial Region. In configuration and climatic conditions this area closely resembles the western pastoral region, from which it is separated by an easterly spur of the Drakensberge known as the Biggarsberge. The region is watered by the Sundays and Buffalo Rivers, both tributaries of the Tugela.

Farming occupations are largely of a pastoral character ; large areas of ' winter grazing ' are sold to farmers who trek their stock from exhausted districts further inland. There is, however, some cultivation of maize, fruit, fodder crops and cotton.

Since about 1890 the region has been remarkable for the rapid development of coal mining, which is now the principal feature of the district. The coal is said to be the best obtained south of the Equator, whilst its occurrence not far from the coast encourages export, and makes it cheap for bunker purposes.

Iron-ore of high grade is mined in many parts of the coalfield, and is being smelted locally ; whilst a proposal to manufacture steel on a large scale is being discussed.

Newcastle (4,000) has a power station, carbide factory, and smelting works. In the district of *Vryheid* (7,000) there are indications of copper, gold, and many other minerals, besides coal and iron. At *Glencoe*, immediately to the north of a pass through the Biggarsberg, the railway divides, one line branching north for Newcastle and Volksrust, the other diverging north-eastwards through Vryheid and Piet Retief. Other mining towns are *Dundee* (4,000), *Utrecht* (2,000) and *Paulpietersburg* (2,000).

CHAPTER XIX.

THE PROTECTORATES.

These Territories are administered not by the Union Government, but by the High Commissioner for South Africa. Each has a separate Resident Commissioner representing the High Commissioner, and each is divided into districts over which Assistant Commissioners preside.

Basutoland. Rather more than a century ago certain small Bantu tribes, pressed on the north by warlike invaders and on the east by the Zulu chief Chaka, took refuge in the mountain strongholds that surround the upper courses of the Orange and the Caledon. They were welded together by Moshesh, a wily and powerful chief who for half a century ruled his highland country by diplomacy and war. The difficulty of fixing the western boundary was very great, and years of tedious warfare between Basutoland and the Orange Free State resulted. First in 1868, and finally in 1883, the country came under the suzerainty of Britain.

Local government is largely in the hands of the natives themselves. The seven districts of Maseru, Leribe, Mohales Hoek, Berea, Mafeteng, Quthing and Qacha's Nek are ruled by chiefs under the guidance of white administrators. The Resident Commissioner is assisted by the Basutoland Council, an advisory body consisting of 100 chiefs.

11,716 square miles in area (i.e., about the same size as Belgium), much of Basutoland is more than 6,000 feet above the sea, whilst the greatest peaks in South Africa lie along the lofty eastern border. From the Maluti the land slopes quickly to the Caledon, but most of the surface is a mass of lofty dissected mountains separated by narrow glens and steep-sided valleys.

Mountain and valley are exquisitely beautiful, and offer superb examples of weathering; and since Basutoland forms the chief watershed of South Africa it is often likened to Switzerland. The scenery, however, is more typically South African, with the characteristics of South African scenery exaggerated. There are no glaciers or lakes; there is no permanent snow, whilst little of the scenery indicates erosion caused by ice and frost; there are no folded mountains or longitudinal valleys, whilst typical Alpine vegetation is absent.

The physical features have permitted a united race to develop. The country is connected by river-valleys with the west and north,

but with the exception of the Orange the rivers run in deep gorges and have not served as connecting links. With the coast-lands to the south and east there has been little geographical contact.

Photo.] [*S.A.R. Publicity Department.*

THE DRAKENSBERGE.

The climate is that which latitude and distance from the sea would lead one to expect, greatly altered, however, by varying altitude. The country suffers the greatest extremes of temperature known in South Africa; summer temperatures reach a maximum of over 90°, whilst in winter 20° of frost are frequently experienced. Although drought is not unknown, the rainfall, which in places is considerable, is fairly regular; the yearly average is about 30 inches. The streams are low in winter, but swollen and turbulent in summer. Snow falls in winter, but acts only to a limited extent as a reservoir of water.

The Basutos are communists, in the sense that there is no private ownership of land. Their wealth consists largely of cattle, horses, sheep and goats, which roam the undulating grasslands, moving to higher parts of the country in summer. There are about 600,000 cattle, three times as many sheep, nearly a million goats, and 150,000 horses; for so small a country, and one in which scientific farming is not practised, these numbers imply great overstocking and consequent soil-erosion.

Apart from the tending of livestock, which graze almost entirely upon the natural veld, the chief means of livelihood is the cultivation of wheat, maize, barley, oats, kafir-corn, beans and peas. These forms of agriculture are confined to the valleys, but are carried on without irrigation. Owing to varying conditions of rainfall and frost, the crops fluctuate greatly. Most agricultural produce is consumed locally.

The external trade amounts to rather more than £2 per head. Clothing, blankets, food-stuffs and small manufactured goods are imported. The principal export is wool; long strings of ponies laden with this commodity, and tied head to tail so that they cannot attempt to pass each other on the narrow mountain tracks, are commonly seen. The remaining exports are wheat and wheat-meal, mohair, maize, hides and skins, kafir-corn and live cattle.

With the exception of Qacha's Nek, which can be approached by vehicle only from *Matatiele*, all the districts are joined together by good roads. The chief road runs from Quthing northwards to Butha Buthe. As in the Union, there are few made-up roads away from the main roads. Most of the streams are bridged, but there is only one mile of railway—that from the Caledon to Maseru.

The population, estimated in 1931 to number 580,000, includes less than 2,000 Europeans; the latter consist of officials, missionaries, traders and labour agents, and are not allowed to own land. Among the Basuto there are fewer males than females, chiefly because of male emigration. The distribution of population is determined largely by altitude, though water supply and fertility of soil also play their part.

For a purely pastoral and agricultural country, the average density of population is extremely high. The river-valleys must have a still higher density, and since they are not scientifically cultivated, are overcrowded. Basutoland is essentially a rural country; apart from the capital, and a few mission and trading stations, there are no concentrated settlements. *Maseru*, with a population of 2,500, is the capital. 86 miles from Bloemfontein, with which it is connected by rail, it is conveniently placed for access to and from the Union, but its situation is not central.

SWAZILAND. Except for the fact of having a dense native population, Swaziland has little justification, geographically, for independence. Basutoland is a typical 'mountain state,' whereas Swaziland, structurally, is joined to the Transvaal and to Zululand.

Swaziland has an area of only 6,705 square miles, but although the distance from the western to the eastern boundary is no more than 80 miles the territory consists of three well-defined natural regions. These regions slope and face seawards, and are known as High, Middle and Low Veld ; these terms, however, do not have exactly the same meaning as in the Transvaal. On the east the boundary follows the Lebombo Mountains from north to south. These highlands slope to the Low Veld, which varies from 500 feet to 1,000 feet in altitude. The High Veld of the west consists of rolling grass country rising from 2,500 feet to nearly 5,000 feet above the sea. Between the two lies the Middle Veld, containing some of the best pasture land in South Africa.

Swaziland is crossed in the north by the Komati and Umbeluzi Rivers, and further south by two tributaries of the Pongola. The gaps in the Lebombo and the Ubombo occupied by these streams afford easy but unhealthy roads to the coast.

The climate and vegetation of Swaziland are very similar to those of corresponding regions in the Transvaal, save that in the Middle and High Veld of Swaziland the water supply is greater and more regular. The rainfall in the Mbabane district varies from 50 to 75 inches annually, whilst, except in the Low Veld, it is seldom less than 40 inches. Over 80% of the rain occurs between October and March. The summers are hot, the Low Veld and parts of the Middle Veld being malarial.

There are about 300,000 cattle, of which number one-fifth are European-owned. Sheep are not numerous, although about 300,000 come for winter-grazing from adjacent parts of the Union. Goats, pigs and mules are reared, but the breeding of horses is hampered by horse-sickness.

Maize and other cereals are cultivated, though none of these is exported. Citrus and deciduous fruits are grown, as well as cotton, ground-nuts and black-leaf tobacco. In the High Veld region there are wattle-plantations. Sugar is not yet a commercial crop.

The most important mineral at present worked is tin, but gold and silver have been mined, whilst many other minerals, including anthracite, are known to exist.

Foodstuffs, including maize and sugar, together with clothing and kafir-truck, are the chief imports, whilst the principal exports are cattle, cotton, tin-ore, tobacco, wattle-bark and hides.

The population numbers about 120,000, including nearly 3,000 Europeans, most of whom are engaged in farming. The Ama-Swazi, a branch of the Bantu race, are a healthy, contented and philosophical people. Large numbers emigrate to the Transvaal in order to work for a few years on the mines. The villages are small, but the population, except in the Low Veld, is well-distributed.

Mbabane is the seat of government; the former capital, *Bremersdorp*, was found to be unhealthy. There are no railways, but roads from Ermelo and Carolina converge upon Mbabane, whilst further south roads connect Piet Retief with *Hlatikulu* and *Mankaiana*. From Mbabane roads run eastwards to Delagoa Bay and southwards to Gollel, the railhead on the Natal border. Road motor services, operated by the South African Railways and by the Portuguese authorities, are helping to develop the country.

Bechuanaland Protectorate. This immense region is the lowest part of the South African plateau; its average elevation is about 3,300 feet. In the east there is fine hill scenery, but usually the surface is flat or gently undulating, having the appearance of a featureless plain. From the region of the Tropic the land falls away very gradually to the lake country northwards and to the Molopo southwards. The Limpopo and its tributary the Marico form part of the south-eastern border, but elsewhere there are no natural boundaries.

In summer daily mean temperatures everywhere exceed 72° F.; in the north they exceed 80°. Winter is a delightful season; the daily mean rarely exceeds 64°. For South Africa these seasonal differences imply a fairly great temperature range. In winter hot days, followed by cold nights, are characteristic.

In the south-west the rainfall is less than 10 inches annually; it increases towards the north and east to over 20 inches, and probably exceeds 30 inches towards the Zambezi. Over 80% of the rainfall occurs in summer. From December to April heavy storms are common.

In many parts of the Union such rainfall is sufficient for a moderately dense pastoral or even agricultural population. In Bechuanaland, however, even more than in the Union, much moisture is lost through rapid evaporation, owing to the extreme heat of the rainy season. As a result, moreover, of the sandy nature of the surface, much water percolates downwards, instead of being drained away by rivers. In flood seasons the river-courses are wide swirling torrents, but more often they are empty ' wadis '; and, whilst some of the lakes occasionally contain water, normally they are empty salt-pans shimmering in the heat.

There is clear evidence that much of Bechuanaland was once better watered. Lake Ngami, described by Livingstone as a fine sheet of water having a circumference of 100 miles, is to-day a reed-grown marsh; it no longer receives water from the Chobe and Okavango, whose channels have become choked with sand, vegetation and débris swept down from the forests in former flood-seasons. Some of the channels leading to Lake Ngami are now being cleared, in the hope that the lake will fill again. The Makarikari Saltpan, 2,000 square miles in area, sometimes receives water from the Botletle, but this narrow channel is also silting

Photo.] [*Dr. R. S. Adamson.*

BORASSUS PALMS (GROWING ON DAMP SOILS), N. RHODESIA.

Photo.] [*Dr. R. S. Adamson.*

PALMS (GROWING ON SANDY SOILS) N. RHODESIA.

Photo.] [*S.A.R. Publicity Department.*

WINDHOEK.

Photo.] [*S.A.R. Publicity Department.*

THE NAMIB.

up. The Schwarz scheme aimed at reconstituting all these lakes and rivers by diverting southwards part of the Cunene and Zambezi waters.

Throughout Bechuanaland subterranean water is abundant, but the water-table is sometimes over 200 feet below the surface. To obtain water even in the river-courses deep boring is often necessary. There is no doubt, however, that, if borings were made of such depth as to avoid the brackish waters nearer the surface, the whole region would have a good supply of sweet water, sufficient for stock-raising if not for agriculture.

In the drier areas the vegetation consists of tufts of desert grasses, with wide sandy spaces between. Where the vegetation is extremely sparse the sand has sometimes been heaped into dunes. Much of the so-called Kalahari Desert, however, has a vegetation which is superior to that of the Karroo. There is much bush, as well as grass ; whilst along the river-courses, and in the northern and eastern districts, trees are numerous. Thorn-trees and acacias are most common, but broad-leaved trees grow in the better-watered areas. Baobabs and palms are numerous in the north, where the grass is more continuous than in the Kalahari region. The mokolane palm, which grows in the Okavango swamps, yields vegetable ivory. A valuable food-plant, found wild but also cultivated, is the tsama melon, which sends long roots deep into the sand in search of water.

At present the Protectorate is essentially a pastoral country. Cattle number about half a million ; about 30,000 are exported annually. There are 400 registered creameries, native-owned. About 300,000 sheep and goats are reared, but owing to sickness mules and horses are not numerous.

Agriculture is a hazardous undertaking. Good rains produce phenomenal crops of maize, kafir-corn, beans, pumpkins, melons and ground nuts, and tobacco has been cultivated successfully ; but agricultural produce is seldom exported.

Apart from cattle, the principal exports are sheep and goats, dairy produce, native curios, hides, skins and karosses, and a little gold. Blankets, clothing, foodstuffs, farm-implements, vehicles and kafir-truck are the chief imports.

The only railway is that running along the eastern border to Rhodesia. Dams have been constructed along this line to supply the railway with water. Plans are at present being considered for a railway from Rhodesia to South-West Africa ; such a railway would cross Northern Bechuanaland. The most-favoured project is that of a line from *Matetsi*, between *Wankie* and *Livingstone*, to *Gobabis* (S.W.A.). The distance from Matetsi to *Walvis Bay* would be 75 miles greater than from Matetsi to *Beira*, but the Walvis route would involve a saving of over 2,000 miles to

Southampton. The only engineering difficulty would be to bridge the Botletle, and the line would cost no more than £2,500,000 to construct. The railway would be of immense benefit to Bechuanaland. Along the route there are good pasture grasses of high feeding value, whilst water is abundant at depths varying from 20 to 76 feet. It is thus estimated that land along the railway could support 25 cattle to the square mile—a total of 1,700,000.

Near the existing railway there are good roads, suited to motor transport, and a south-to-north motor road is under construction. Motor lorries use the beaten tracks that connect Ngamiland with Livingstone, and Ghanziland with Gobabis, but such routes are useless or dangerous in summer. Mails are carried by runners or by ox-wagon.

The total population is less than 200,000, including some 1,800 Europeans, for whom 7,500 square miles are reserved. There are 165,000 square miles of unoccupied Crown land, whilst Native Reserves cover an area of 100,000 square miles.

There are a few Hottentot villages, and wandering Bushmen, whose chief food consists of roots and berries, hunt wild animals. These they kill by means of mamba-poisoned arrows, for their skins.

The vast majority of the population are Bechuana (more properly Becouana), of whom there are many tribes. The most advanced are the Bakghatla, numbering about 12,000 ; the chief town of their reserve is *Mochudi* (8,000), on the railway 124 miles to the north of Mafeking. Further south live the Bangwaketsi, whose capital is *Kanye* (12,000) ; the surrounding country is hilly and picturesque, and abounds in game. *Serowe* (25,000), west of Palapye, is the headquarters of the Bamangwato, who number 59,000. Serowe is probably the largest native town in South Africa. The site was chosen by the enlightened chief Khama, who moved his capital from Shoshong to Palapye, and later to Serowe. The principal remaining tribes are the Bakwena, the Batawana and the Bamalete, numbering altogether 35,000 ; their administrative centres are respectively *Molepolele* (9,000), *Maun* (5,000) and *Ramoutsa* (3,500).

The towns named above are usually groups of villages. The thatched circular huts, which are built of mud, reeds, and sun-baked bricks, are scattered irregularly. Usually they have only one room, so that one family sometimes possesses several huts. Women fetch water and grind corn, and sometimes attend to cultivation. The men hunt and tend cattle.

The European population is scattered, although settlers are being encouraged to take up land in the Tati area. This region, formerly part of Matabeleland, is suited to grain, tobacco and citrus. Gold to the annual value of about £8,000 is mined locally. *Francistown* is the administrative centre for Northern Bechuanaland, but the headquarters of the whole Protectorate is *Mafeking*.

CHAPTER XX.

SOUTHERN RHODESIA.

PHYSICAL FEATURES. Southern Rhodesia is part of the African plateau, having, however, a greater relative extent of unbroken upland. Over 80% of the country is more than 2,000 feet above sea level, but less than 3% has an elevation exceeding 5,000 feet. Rhodesia lies wholly within the tropics, but the relatively great altitude so modifies temperature that the climate is one of the most pleasant in the world. The scenery is not so rugged or harsh as in the Union, consisting generally of open rolling grassland with patches of dense bush or open forest.

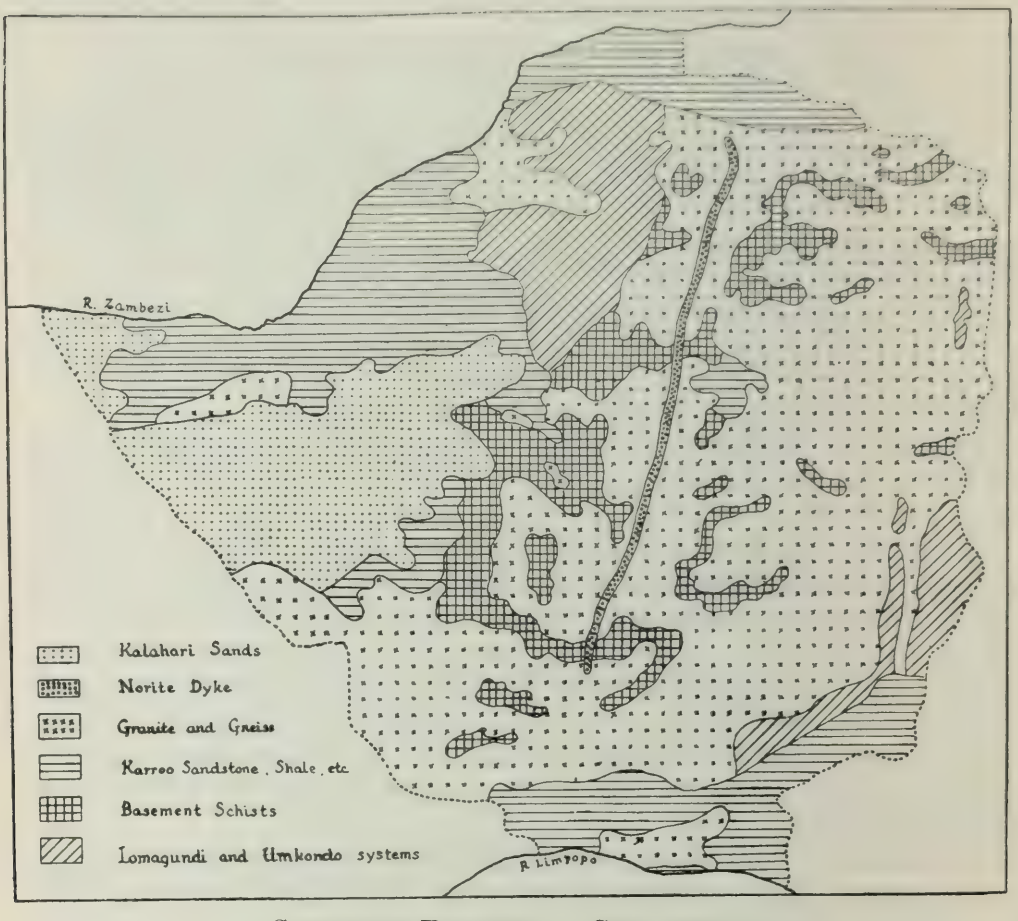
The most striking topographical feature is the higher plateau which runs north-eastwards from Plumtree as far as Gwelo, and then eastwards to Umvuma. From Umvuma it trends again in a north-easterly direction as far as Marandellas. Here the higher plateau is widest, and sends out an easterly spur which reaches the lofty Inyanga highlands, the massive scarplands which form part of the eastern border. The summit of Inyangani (8,250 feet), is the highest point in Rhodesia. Southwards the scarp is continued in the Udzi Mountains and the Melsetter Highlands, whose highest peak is Chimanimani (7,446 feet). Beyond this point the scarp diminishes in altitude, falling smoothly to the lowlands of the Sabi River.

This well-developed scarp is broken at Umtali by a convenient but narrow gap. Otherwise it affords a real topographical boundary. The political boundary, however, rarely follows the highest part of the scarp; it lies nearer the 3,000 feet contour, sometimes east, and sometimes west of the scarp. From the Sabi the boundary runs south-westwards in a straight line to the Limpopo.

A prominent feature to the north of Salisbury, where the higher plateau is wider than in the south, is the Umvukwe Range, overlooking the Lomagundi district to the west.

From this bold higher plateau, which cuts Rhodesia into two unequal portions, a smaller region falls southwards to the Limpopo, and a larger one northwards to the Zambezi. Near the north-western boundary the land bordering the Zambezi is less than 3,000 feet above sea-level, but only a small proportion of the entire country is low-lying, hot, and humid.

The higher plateau is the chief watershed, and sends rivers to the north, northwest, east and south. These rivers, especially in their middle courses, have bitten deeply into the land, thus dividing the plateau into great blocks. These blocks are surmounted by isolated koppies, themselves also the result of erosion caused by smaller streams. The whole region is gradually, however,



SOUTHERN RHODESIA: GEOLOGICAL.

being reduced to a peneplain. Where the rivers leave the higher plateau a small but often steep scarp is evident, and along the eastern scarplands headstream erosion is causing the formation of precipitous gorges. The only streams flowing westwards from the main watershed are two rivers which flow into the Makarikari.

The rivers of Southern Rhodesia are of little use for navigation. In winter most of them are dry; in summer they are frequently swollen torrents of such violence as to destroy bridges. The use of boats on the larger rivers, moreover, is rendered difficult by cataracts, shifting banks, and sandbars. But in Rhodesia, as in other 'young' countries, rivers often serve as boundaries, particularly as district boundaries.

GEOLOGY—SOILS AND MINERALS. The geological map should be studied with care, as the distribution of soils and minerals is controlled largely by geology. The geology is also interesting from a physical point of view, for many of the typical land forms are due to the behaviour of different rocks under the influence of erosion.

Considerably over half the area consists of granite and other intrusive igneous rocks, whilst volcanic outpourings cover many thousands of square miles. The granite occurs in two forms, gneissic and massive. Gneissic granite forms rolling bush country, with no prominent relief; the massive form is typified by blocks of 'koppie' country, (e.g., the Matopo Hills), usually from ten to thirty miles across, and separated from each other by narrow belts of schist, called Basement Schists. Banded ironstone, forming tree-clad sharp-crested hills, like the Salisbury and Gwelo koppies, occurs in these schist belts, which here and there contain chrome ore (as at Selukwe), and chrysolite asbestos (near Victoria and at Shabani).

Gold is not concentrated in a single gold-bearing reef, as in the Transvaal; it is widely distributed throughout the granite and in the rocks of the Lomagundi and Basement Schists. Thus, whereas the Rand is the scene of great company development, the Rhodesian fields are worked by small companies and by individuals. Workable beds of coal have been proved to exist in the Wankie, Sebungwe, Lomagundi, Gwanda and Ndanga districts, but up to the present only the Wankie fields have been worked. Here the seam mined exceeds 13 feet in thickness, and the coal has excellent steam-raising qualities. The reserves are enormous.

A striking topographical feature is the great Dyke, which stretches for three hundred miles from the Umvukwe Hills southwards to the Doro Hills in the Belingwe district. It is some four miles in width, and is composed of an igneous rock called norite, whose mineral content is high. The surface is grass-covered. The following details, studied in conjunction with the geological map, will show the distribution of soils in Southern Rhodesia. (The subject is of importance, since in Rhodesia the distribution of farm-industries is determined very largely by soil, and only to a lesser degree by climate.)

Rocks and Soils: Relative Areas.

Granite, 49·5%; Karroo sediments, 15·3%; Kalahari sands, 11·2%; Basement Schists, 8·5%; Lomagundi formation, 5·7%; Basalt and Dolerite, 5·1%; Umkondo formation, 2·7%; Great Dyke, 0·8%; not determined, 1·2%.

The Kalahari sands are poor in fertility, but the granite decomposes into good sandy loams on which bright Virginian tobacco does well. The Karroo soils vary; the grits and sandstones yield poor sandy soils, the shales produce loams and clay soils, whilst the basaltic lavas decompose into soils of great fertility. Maize is grown on the Basement Schists, whose soil is rich, red and loamy. The Lomagundi and Umkondo quartzites, shales and slates yield clay soils and sandy loams. Where intrusive dolerite occurs, as in the Great Dyke, the soils produce excellent pasture. The most fertile soils are the 'black vlei' soils; sometimes they are alluvial, but in places they are derived from the underlying rocks. These soils are widely distributed throughout the Karroo formations, and occur also in granite areas. Where they overlie granite they are excellent for winter crops such as wheat, since they hold moisture for several months. Where they are well drained they yield heavy maize crops in summer.

In the recently-formed rocks alluvial gold and some 'float' gold are found. These rocks also yield guano, brick-clay and saltpetre. Ironstone is found in the Kalahari sands, and sandstone (for building), brick-clay, fire-clay,

and coal are obtained from the rocks of the Karroo formation. The Umkondo system yields limestone and copper. The Great Dyke bears numerous valuable minerals such as chromium, asbestos, platinum, magnesite, magnetite, nickel and opal, whilst from the adjacent rocks gold, silver, copper, lead, zinc, bismuth, mica, beryl and triplite are obtained. The Lomagundi system contains phosphates and graphite. In the Basement Schists iron, limestone, asbestos and corundum are present. Gold, silver, lead, copper, antimony, tungsten, arsenic, nickel, barytes, tantalite, magnetite, bismuth and molybdenite occur in the Granite and Gneiss formations.

Climate. Although Southern Rhodesia lies entirely to the north of the Tropic of Capricorn, the climate is modified by the altitude of the plateau. There are two distinct seasons, a wet season and a dry season. Everywhere temperature decreases and rainfall increases with altitude, except in the Zambezi valley. Generally speaking, summer temperatures are highest in the south-west and north-east. The latter, however, has much more rain than the former.

In summer a region of low pressure is centred south of the Zambezi. Winds from the warm Indian Ocean accordingly pour in from the east and north-east. Winds blow also from the north and west. The rainfall is therefore greatest in the east and north-east, less in the north and north-west, and least in the west, south-west and south.

In winter the land is under the influence of the sub-continental high-pressure system, and winds blow northwards and north-westwards to the low-pressure areas over and north of the Equator. Since they cross the land, and come from the relatively cool south, they are dry. Over 90% of the rainfall comes in the summer half-year.

The wet season normally extends from October till the end of March, though October is sometimes rainless, whilst the rains may extend into April. Until the end of December the rainfall is slight; it occurs in the form of occasional thunder-showers, lasting only an hour or two, with intervening fine periods. From January till March the rains are heavier and more continuous; during this period a dry week is rare.

The highlands along the eastern border have a more evenly-distributed rainfall; as a result of altitude drizzling rains and occasional heavy showers occur in winter as well as in summer.

It is important to remember that in Southern Rhodesia the rainfall seldom diverges greatly from the normal. The average rainfall over the whole country is 28·8 inches, and the divergence from the normal is only 8 inches. That is, in any but really abnormal years the rainfall will vary between 21 and 37 inches. Thus Southern Rhodesia has the advantage of a rainfall that varies from the normal to a lesser extent than that of the High Veld of the Union.

Southern Rhodesia is usually divided into six rainfall regions :

Region '*A*,' comprising the following north-western districts : Wankie, Sebungwe, Bubi, Nyamandhlovu, Gwelo (western part), Bulawayo, and Bulalima.

Region '*B*,' including districts to the east of the main watershed : Mangwe, Matobo, Umzingwane, Insiza, Gwanda, and Belingwe (southern part).

Region '*C*,' consisting of districts to the north-west of the watershed : Hartley, Lomagundi, and parts of the Gwelo, Chilimanzi, Salisbury, and Charter districts.

Region '*D*,' comprising districts to the north and north-east of the watershed : Mazoe, Darwin, Mrewa, Mtoko, and parts of the Salisbury, Marandellas, Makoni and Inyanga districts.

Region '*E*,' including districts to the east and south-east of the watershed : Gutu, Ndanga, Victoria, Selukwe, Chibi, and parts of the Marandellas, Makoni, Umtali, Melsetter, Charter, Chilimanzi, Belingwe, and Insiza districts.

Region '*F*,' consisting of Eastern Border districts such as Umtali and Melsetter.

Some features of the differences between these six not very divergent regions are indicated in the table below :

		Average Rainfall	Driest Station	Wettest Station	Rainfall Apl.-Sep.	Rainfall Oct.-Dec.	Rainfall Jan.-Mar.	Rainy Days Apl.-Sep.	Rainy Days Oct.-Dec.	Rainy Days Jan.-Mar.
Region	'*A*'	26·0	21·9	29·9	1·3	9·7	15·0	5	21	31
,,	'*B*'	21·3	15·9	27·3	1·1	7·5	12·4	7	20	29
,,	'*C*'	31·5	28·8	35·3	1·4	10·4	19·7	7	26	39
,,	'*D*'	33·7	28·5	40·0	2·0	11·0	20·8	7	22	41
,,	'*E*'	31·8	22·1	54·7	2·3	10·2	19·3	13	25	38
,,	'*F*'	52·8	42·6	63·8	6·5	14·6	31·7	31	29	45

Temperature varies with altitude, latitude and distance from the sea. There is an average decrease of 2·5° F. for every 1,000 feet ascended. From south to north the means increase of about 1° F. for every two degrees of latitude. From east to west there is an increase of 1° F. for every degree of longitude. The lowest temperatures are therefore found in the south-east, although most of the plateau is admirably suited to white settlement.

Winter lasts from May to August, when the climate is bracing and delightful. Frosts are common at altitudes exceeding 3,000 feet, but they are neither heavy nor of long duration. In the Low Veld the minimum temperature is rarely below 45° F.

It is hottest not in midsummer but in September and October, which are the least pleasant months of the year. Fortunately these hot months experience a low humidity, and at night radiation is so great that the air is fairly cool. On the higher parts of the plateau the thermometer seldom reaches 100° F.

As the sun passes overhead in November, December and January, temperatures are modified by the great amount of cloud, so that these wet months are not so hot as September and October. But during this wet season night temperatures are high, since the blanket of cloud prevents rapid radiation.

The following tables illustrate the effect of altitude:

Altitude.	*Percentage of Total Area.*	*Mean Annual Temperature.*
Under 1000 feet ...	·7 ...	82° – 76° F.
1000 – 2000 „ ...	14·1 ...	80° – 74° F.
2000 – 3000 „ ...	22·2 ...	77° – 70° F.
3000 – 4000 „ ...	38·4 ...	72° – 65° F.
4000 – 5000 „ ...	22·7 ...	68° – 63° F.
Over 5000 „ ...	1·9 ...	65° – 60° F.

	Mean Maximum.	*Mean Minimum.*	*Mean Annual.*
High Veld ...	78·0° F. ...	53·8° F. ...	65·9° F.
Low Veld ...	86·6° F. ...	56·5° F. ...	71·5° F.

As Southern Rhodesia is nearer the Equator than the Union the cloudless winter days are longer, whilst the three wet summer months are cloudier. The average amount of sunshine throughout the year is 7·4 hours per day.

The country is healthy if suitable precautions are taken, and the death-rate is low. Malaria, blackwater fever, and other ailments are prevalent, especially at low altitudes, but can be avoided with reasonable care.

According to Professor Griffith Taylor the white man is not able to settle and retain his European mode of life if the wet-bulb thermometer exceeds 65°F. for most of the year. In Southern Rhodesia 6% of the total area never experiences a wet-bulb temperature of 65°F., 18% has from one to three months, 40% has from three to six months, and 36% more than six months. The last is the low-veld country, and is suited only to the 'plantation settler' and to stock-raising. According to the above figures about two-thirds of Southern Rhodesia is suited to white settlement.

Vegetation. The distribution of vegetation is controlled mainly by climate, altitude and soil. Thus the dry areas of the south and west differ from the plateau, whilst the plateau differs from the lower areas to the north. The lands of the well-watered eastern border, again, are different from the western peneplain. Even isolated hills stand out in contrast to the surrounding grass-covered areas by reason of their wooded slopes. Porous soils, moreover, react differently from impervious soils.

Broadly speaking, there are three types of vegetation: (1) grassland, (2) open tree-veld, (3) low-veld forest or close forest.

The high eastern border districts consist of temperate grasslands, the grass being short and sweet and palatable to sheep. In the Sabi valley buffalo grass is abundant. Much of the plateau is covered with coarse giant tambookie grass, but this improves greatly with careful grazing, and may eventually become suited to sheep. Matabeleland carries grass which is more nourishing than that of Mashonaland, which, on account of its superior rainfall, is better suited to arable farming than to grazing. As in the Union, veld-burning causes the grass to become tough, and also results in the veld being covered with widely-spaced wiry tussocks.

Most of Southern Rhodesia can carry trees ; indeed, much of the higher plateau and middle veld was once woodland, but forest fires have destroyed thousands of square miles of fine timber. Large areas of forest have also been burnt by natives in their ' nomadic agricultural ' manner.

As yet there has been little exploitation of the timber except in the Kalahari sand-veld. Some authorities predict a great future for wattle cultivation. About 60% of the total area at present consists of tree-veld, close forest or low-veld forest.

The open tree-veld varies in type according to altitude and rainfall. Parts of the highveld support fine grass and scattered thorn-trees. In the north-east of the plateau the tall msasa is common. The umgusu is found almost entirely in the Kalahari sand areas, where it mingles with the Rhodesian mahogany (urutjiba).

The low-veld or close forests also differ in character according to rainfall. In dry areas baobab and mopani trees, with a very poor undergrowth, are characteristic. The eastern border mountain forest possesses large trees, many of them evergreen, with an understorey of small trees and shrubs. Similar vegetation occurs along the rivers, more often on the valley-slopes than along the banks ; it is then called fringing forest.

Irrigation. In its present stage of development the need for irrigation in Southern Rhodesia is not so great as in the Union, but irrigation will become increasingly necessary in most parts of the country for the cultivation of winter crops, and in the drier areas to ensure ' safe ' crops in summer. In Mashonaland most winter crops are grown by irrigation, and on most of the farms a small dam has been built. The largest is situated on the Mazoe River, 30 miles from Salisbury, where 6,000 acres are under irrigation. Wells and boreholes have been sunk, but the amount of underground water appears to be inconsiderable.

About 45,000 square miles receive less than 25 inches of rain annually. Most of this semi-arid country is at present unpopulated, and has neither roads nor railways. With the construction of dams on many of the rivers, water could be conserved in sufficient quantity to irrigate huge areas admirably suited to agriculture and stock-farming, but the absence of markets and of skilled labour will for many years discourage such development.

The total irrigated area is at present only 14,000 acres.

Agriculture. Cultivation is confined mainly to the higher parts of the plateau and to lands not far from the railway, although the recent construction of motor roads is causing agriculture to be more widely distributed. Both temperate and tropical crops are cultivated.

The chief crop is *maize*, which grows well on the Basement Schists, especially in the Salisbury, Lomagundi, Hartley and Gwelo districts. There are two types of sowing, 'long' and 'short' season. 'Long season' planting takes place in November, and the 'short season' about the end of the year. The average yield is only about 6 bags to the acre, which, however, is greater than the average yield in the Union. The total crop is about two and a half million bags annually; rather less than a third of this amount represents native production. Maize is the staple food of the natives and an important fodder crop. In some areas it is ploughed in for green manure. Much is exported, especially the fine quality grown from 'White Flat' seed. In the future a larger part of the crop will be used locally for beef production.

Another valuable crop is *tobacco*, although the production has decreased greatly in recent years (1928, 25 million pounds; 1930, 6 million pounds). Tobacco was known to the natives long before European occupation. It grows easily, especially in sandy granitic soils and in clay loams, but the rainfall factor limits commercial cultivation to certain districts; the greatest production is in the Salisbury and Marandellas districts. Turkish tobaccos are grown near Bulawayo, but the type most generally cultivated is the Virginian. It is possible that the industry may be encouraged by the increased preferences recently granted by Great Britain.

Over large areas soil and climate are suited to *cotton*, but the yield is low, the staple is short, and in certain seasons insect pests have played havoc with the crop. In 1925-6 66,000 acres were planted with cotton; in 1929-30 the acreage was only 6,000 acres, yielding less than two million pounds of seed-cotton.

Ground-nuts are grown nearly everywhere, but the yield per acre is low and could be increased fivefold. This product can be utilized in a great variety of ways; in Salisbury it provides raw material for soap-making.

Fodder-crops. As the winter veld yields poor grass for live-stock, the growing of fodder crops is of great importance. About 7,500 acres yield 35,000 bags of sun-flower seeds annually, and another 10,000 acres are planted for green manure. The natural veld yields good hay if mown at the proper season. In addition to maize, sweet potatoes, pumpkins and melons are used for silage. Rhodesia is fortunate also in being able to produce an abundance of legumes.

Winter-crops comprise wheat, oats, barley and rye. Potatoes and other vegetables are also grown for the home market. There is a serious deficiency of wheat, only one-sixth of the local need being satisfied. The cultivation of these crops would be increased enormously by irrigation.

Fruit. Oranges and grape-fruit are the chief fruits grown for export. The fruit is of good quality, though small. The dry ripening season permits safe transport, as the fruit leaves the country firm and strong. The fruit is exported from Beira, Durban and Cape Town between April and October. Apples are grown in the elevated districts near the eastern border, and pears, peaches, plums, apricots and quinces are produced on the High Veld. Sub-tropical fruits such as mangoes, pawpaws and bananas grow on the Low Veld, but are not exported.

Pastoral Industries. Both dairy and ranch cattle are extensively reared. The natives have large herds, and altogether possess some 1,600,000 head. Europeans own about 900,000. Most farmers own herds numbering between 600 and 1,000 head.

Dairy cattle are most numerous near the railway and near the larger towns. At Gwelo, Salisbury, Bulawayo and Umtali,

dairy produce is manufactured, some being exported. There are great herds of beef-cattle. There is a bright future for meat-producers in a world which is rapidly becoming deficient in meat supplies. Rhodesia already has a considerable local market in the Congo and in Portuguese East Africa. With the eradication of the miserable scrub bull and with improvements in marketing, export trade to Britain and the Continent should develop greatly. Large areas of the High and Middle Veld are suited to ranching and land is cheap. Cattle will ' run the ranches ' for two years and then be taken to areas where they can be fattened. In addition to small quantities of beef, about 60,000 slaughter-cattle are at present exported annually. High-grade cattle are still being imported.

Apart from the highlands along the eastern border, there are few areas suited to sheep, of which Southern Rhodesia has less than 400,000. Usually the flocks number from 50 to 300. The indigenous type and Blackhead Persians are most numerous ; some merinos are imported. Where the veld has been well-grazed and ' softened ' mutton-sheep could be reared in greater numbers, but conditions are not favourable to woolled sheep. Wool and skins are exported.

Goats are far more numerous than sheep. This animal is a favourite with the natives. Horses are not numerous, although ' salted ' animals, i.e., those immune to disease, are being introduced.

Cattle in Rhodesia are exceptionally free from disease compared with other parts of Africa, but East Coast fever is prevalent, whilst some seven million acres are infected with tsetse-fly. Foot and mouth disease has not yet been eradicated, but it is not usually serious.

Horses and mules suffer everywhere from horse-sickness, especially if they are allowed to run freely on the veld during the rains. Pigs and donkeys are free from disease, but sheep are afflicted with scab.

Mining. The total value of mineral production in Southern Rhodesia since European occupation has been about £100,000,000. Gold accounts for three-quarters of the total. The ratio of base-metal production to that of gold, however, is increasing ; both in 1929 and 1930 the output of gold was about equal to that of base metals.

Gold is widely distributed and is usually worked quite easily. The industry is therefore carried on by small companies and even by individuals. Gold is obtained in three ways : (*a*) from the ancient fields, which are worked by sinking short vertical shafts, (*b*) from open excavations which yield ' surface ' or ' rubble ' gold by screening and crushing with gravity stamps, (*c*) from new reefs lying at a depth of perhaps 2000 feet and reached by deep shafts.

Southern Rhodesia has large quantities of high-grade asbestos, and is second in the world production of this mineral. It is mined chiefly at Shabani and Mashaba. Chrome ore is mined at Selukwe and in the Great Dyke ; the country provides half the world's output. Coal is present over enormous areas, and is probably the best in Africa. It is at present worked only at Wankie ; the annual production is about 1,000,000 tons. There are immense reserves of iron, but none is worked by modern methods ; it is sometimes mined and used by natives. Mica, lead, silver, aluminium, and other metals are worked, and great quantities of precious stones, particularly diamonds, are known to exist.

Nearly all the mines are small, only three having more than 2000 workers. There are six with between 1000 and 2000, sixty-four with between 100 and 1000, and two hundred with less than 100 workers. Except in gold-mining, however, there is a tendency for the smaller mines to be concentrated under the control of larger companies.

The mines employ about 1,700 Europeans and 45,000 natives. There is no shortage of labour, for although the indigenous supply is insufficient there is an abundance to be obtained from neighbouring countries, which contribute 74% of the total number of mine-workers.

Communications. The railway from Plumtree follows the watershed as far as Gwelo, descends by way of more difficult country to Gatooma and thence climbs to Salisbury. From Salisbury there are short branch lines to the north-west and north-east, the main line turning south-eastwards to Umtali and Beira. This section was the most difficult to construct, for the gradients are steep, and marshy lowlands have to be traversed. The main line to the north goes north-westwards from Bulawayo to the Victoria Falls. It avoids the main rivers, which lie in deeply-eroded beds. From Gwaai the line runs dead straight for 72 miles, the longest straight run in Africa. After passing the Wankie collieries, the railway curves through difficult country to the Zambezi. Branch lines run from the Bulawayo-Gwelo section of the main line south-eastwards to West Nicholson, Shabani, Selukwe and Victoria.

The railways do not serve very much of the total area of this young country, but most of the European settlements are within 25 miles of the line. Few countries have so great a mileage for so small a civilized population ; there is one mile of railway for every 20 Europeans (Union 160). Future railway development will depend upon the growth of population, increase in agricultural, pastoral and mineral production, and the desire for cheap and rapid access to the outside world. Thus it is proposed to connect West Nicholson with Messina *via* Beitbridge, and so bring Rhodesia into closer communication with the Union. A more ambitious proposal is the construction of a line to Walvis. The advantages of this outlet would be great. At present most Rhodesian exports leave Africa by Beira or Cape Town. If by the former, the sea-route is long. If by the latter, there is a long and expensive railway journey. But the distance from Rhodesia to Walvis is

less than to Cape Town, whilst Walvis is nearer Europe than either Cape Town or Beira ; and beef, dairy produce and citrus fruits would reach Europe in better condition if sent *via* Walvis than by either of the other routes. The proposed line, which would be inexpensive to construct, would also benefit the Bechuanaland Protectorate.

In recent years there has been much progress in the construction of all-weather roads and of high-level and low-level bridges, and in the provision of road motor services which feed the railway. There are some 8,000 miles of roads, many with surfaces suited to motor traffic. Owing to rapids, and since the water-level in winter is low, the rivers are generally useless for navigation.

Manufacturing and Commerce. Manufacturing industries are of no great importance. There are flour mills at Gwelo and Bulawayo, and breweries, tobacco factories and fertilizer factories at Salisbury. Cement is manufactured near Bulawayo. Dairy produce, clothing, soap, candles, cattle-cake, furniture and wagons are made in many centres.

Imports, which vary in value from five to eight million pounds, include machinery and vehicles, foodstuffs, textiles and apparel, chemicals, and miscellaneous manufactures. Half come from Britain and another quarter from other parts of the Empire. Most of the foodstuffs imported could be produced locally.

The exports, which in average years equal the imports in value, include gold, asbestos, chrome ore, slaughter cattle, tobacco, maize, fruit, hides and skins, and dairy produce.

The Portuguese port of *Beira*, 200 miles from the eastern border, handles over 80% by tonnage and over 50% by value of Rhodesia's foreign trade. Beira is situated near the mouths of the swift and turgid rivers Pungwe and Buzi, which are navigable for small steamers for some 40 and 25 miles respectively. A sandbank affords shelter from the north-east winds, and at high tide vessels drawing 24 feet can enter the harbour. The tonnage of vessels calling at the port exceeds three millions annually, about three-fifths of the total being British and the remainder chiefly Portuguese and German. Arabian vessels, interesting relics of the age-long trade between Africa and South-West Asia, also visit the port. The population is 16,000, of whom one-eighth are Europeans.

Population and Labour. 95% of the total population of 1,097,000 (1931) are natives. The Europeans number 50,000—twice as many as in 1911 ; male Europeans exceed females by 5,000.

The average distribution of population is about one European and twenty natives to every three square miles, an average

density for all races of about seven to the square mile. 89% of the Europeans live at an altitude exceeding 4,000 feet ; in general Europeans in Rhodesia enjoy good health—the birth rate is high (24 per thousand) and the death rate unusually low (10 per thousand). About one-third of the European population are Rhodesian-born, a similar number were born in the Union and the remaining third in Great Britain. The least populated areas are the Low Veld, the mountainous eastern border and the arid western region.

Most of the natives lead essentially rural lives ; some farm their own land, others work on European farms as labourers. Their agricultural methods are primitive ; they know little of deep ploughing or of fertilizing the soil, and the yield per acre is low. Their food consists mainly of maize and millet. The remaining natives, many of whom are not indigenous, are engaged in mining and other industries, and in domestic service. The annual import of labourers from neighbouring territories exceeds 57,000.

Chief Towns (European population in brackets). *Salisbury* (7,200), the capital, is the centre of an agricultural and mining district having a fairly abundant rainfall and a healthy climate. The town lies 4,865 feet above sea-level, so that even in summer the nights are cool. To the north stretches the chief maize belt of Rhodesia, whilst to the south the 'granite veld,' though not suited to maize, is well suited to mixed farming and dairying. Salisbury gets its water supply from the Hunyani River, seven miles distant. It is a road and railway junction of general importance, and an airport on the Cape to Cairo route. *Bulawayo* (10,600) is also a junction town, and stands amidst fine grazing country and irrigated lands yielding a variety of crops. The mean annual rainfall (23·6 inches) is somewhat low, but the town derives water from a large dam on the Khami River. Bulawayo is the centre from which the Matopos are reached ; on the loftiest of these rugged granite hills Rhodes is buried. *Umtali* (2,100), on the railway line to Beira, commands the Eastern Gate, and is the market centre for the highlands. The surrounding country, which possesses much fine scenery, is a productive farming and mining area. From Umtali there are roads into the Inyanga and Melsetter districts. *Gwelo* (1,300) is the centre of a rich mining region producing gold, asbestos, alluvial diamonds and chrome iron. The chief farm product of the district is maize. From Gwelo there are branch lines to Selukwe and Victoria, both market towns for mining and agricultural areas. The ruins of Great Zimbabwe are reached by road from Victoria. *Wankie* (650), the centre of the coalfield, has a hot climate owing to its northerly position and low altitude. *Gatooma* (600) is beautifully situated amidst pastures and rich agricultural lands. The climate is particularly well suited to cotton, tobacco and maize. The town has a cotton ginnery. The surrounding region contains the principal gold-mines in Rhodesia ; chrome-iron, copper, antimony, silver and platinum are also present.

CHAPTER XXI.

NORTHERN RHODESIA.

Northern Rhodesia is a vast plateau trenched by large tributaries of the Zambezi. It is unlike any other area to the south in as much as huge swamps and lakes lie on the flatter parts of the uplands, but, generally speaking, the country is undulating, and its altitude exceeds 5,000 feet only in the Muchinga Mountains (the Serenje-Mpika plateau), and in the Tanganyika Plateau. This latter must be distinguished from the adjoining Tanganyika Territory.

Owing to an insufficiency of data it is not possible to speak with any assurance of the geology of the colony. In the south Kalahari sands overlie basalt. Between Zomba and Choma sandstones overlying coal measures or with granitic intrusions are common. From Choma to the Kafue lateritic soils, sandy and clayey loams over granite and basalt, and doleritic intrusions make the land fairly fertile. Nearer Lusaka there is an even higher fertility. Further north the Broken Hill pre-Cambrian rocks and the Bwana M'kubwa formations are renowned for their enormous mineral deposits. Elsewhere detailed geological reports have not yet been made. It is certain, however, that vast areas are covered with intrusive rocks which are highly mineralized.

The climate, modified by the altitude, is tropical. The temperatures in summer are high, but in winter the nights are cool, though the days are bright and sunny. In the great valleys and near the lakes the summer temperatures exceed 110° and the humidity is very high. Most rain falls in summer. The average rainfall for the country appears to be between 25 inches in the south and 35 inches in the north. Lusaka has 33 inches. But there is great variability from season to season. Kalomo had 15 inches one year and 44 inches the next. This variability seems to be common all over the country. The rain falls in very heavy showers, nearly 50% of the total having an intensity exceeding one inch each rainy day. As a result erosion is very serious, more particularly as the rain is of such a seasonal character.

There are three vegetative types: savanna forest, evergreen forest, and tropical grassland. Savanna forest occupies by far the largest part of the country. This is composed of moderately small trees, rarely over forty feet in height. They do not usually

form a continuous canopy; often they are widely scattered. The trees are mainly deciduous, although the period of leaflessness is short. Between the trees there is grass, some two to four feet in height, though in wetter areas, or on soil which retains moisture well (e.g. vlei-soil), it reaches a greater height. As in equatorial regions, there is often a considerable variety of species in a small area. Soil differences account for this to a large extent; indeed, there is a close correlation between soil and tree-type. Generally speaking, in the wetter north, the savanna forest is more dense, forming an almost closed canopy. This type is also found in Barotseland, where the Rhodesian teak grows thickly in the deep sandy soils. In the drier areas the trees decrease in size and distribution, and in some places degenerate into low bush.

The evergreen forest is not extensive, but occurs along the river banks as a fringing belt, especially in the warmer and wetter valleys. On the higher elevations nearer the northern boundary and Lake Tanganyika this forest is ubiquitous.

The grassland is found, as a rule, near savanna country, especially where there are shallow flat-bottomed valleys which are liable to become waterlogged in the wet season. The grass is tall and rankly coarse. In the middle reaches of the Kafue River extensive flat areas of treeless plains occur. These areas are also liable to water-logging. Exceptionally tall grasses are found in swamp land, especially in areas of inland drainage. The Lukanga Swamp is typical of such grass vegetation.

Northern Rhodesia has a considerable future as an agricultural and pastoral country, but at present there has been little development. Subsistence farming is possible over wide areas. Farming on a wider scale depends so largely on good communications that the full benefits of agricultural and pastoral farming are not likely to be experienced until roads and railways cover the country in all directions.

Apart from native farming, most agriculture is practised within thirty miles of the railway; usually it is much closer. There are two other centres, Fort Jameson in the south-east, and Abercorn on the Tanganyika plateau. Both regions have closer economic connections with adjoining territories than with the Colony. Cattle thrive well, although some areas are infected with tsetse-fly.

There is some cultivation of cotton and tobacco, and of wheat by irrigation. Citrus fruits, sorghums, manna, pumpkins and oil-seeds are also produced in small quantities. Cotton was grown extensively in 1924 (17,000 acres), but a series of wet seasons has shown that a more suitable seed is necessary to ensure its being anything but a catch crop. Tobacco and other agricultural produce from the Fort Jameson district is exported *via* Blantyre, three hundred miles distant. In the neighbourhood of Abercorn

Photo.] [*Dr. R. S. Adamson.*

TEAK TREES, VICTORIA FALLS.

Photo.] [*Dr. R. S. Adamson.*

RAIN FOREST AT 5000 FT. (RAINFALL 60″).
UMTALI, S. RHODESIA.

[*Dr. R. S. Adamson.*

Photo.]

TEAK FOREST, N. RHODESIA.

[*Dr. R. S. Adamson.*

Photo.]

MOPANI TREES ON CLAY SOILS: KAFUE RIVER, N. RHODESIA.

coffee is grown, and exported *via* Lake Tanganyika and Dar-es-Salaam. The best farming country lies between Livingstone and Broken Hill.

There are about 25,000 acres of maize yielding on an average 4·9 bags to the acre. Europeans own about 100,000 cattle, which are reared for beef and dairy produce. In good seasons the export is 5,000 head. Choma, Pemba, Mazabuka, Lusaka, Kafue, and Kalomo are the chief tobacco districts. About 3¼ million pounds were produced in 1927, but in recent years the annual production has fallen to one-half this amount.

As the mineral workings increase in the Colony and in the Belgian Congo, the demand for food for mine-workers will also increase. At present a great deal of food is imported. But single-crop farming, lack of co-ordination amongst farmers, distance from rail-head, absence of all-weather roads, ignorance of stock-breeding, and the variability of the rainfall, have so far been serious disadvantages. There can be no doubt that a great development will take place in farming when the mining industry is more securely established.

Northern Rhodesia is particularly fortunate in as much as she possesses one of the world's greatest mineral areas. From Broken Hill to the border and beyond to the Katanga Province in the Belgian Colony lies the famous Copper Belt. Hundreds of other minerals are also found here. Ndolo is the centre of the Copper Belt and the headquarters of the Mines Department. Bwana M'kubwa is the chief district. The amount of copper is enormous, and plant has been installed which will produce more than 100,000 tons each year. The Nkana and Roan Antelope mines will each yield 7,000 tons of ore per day. The copper is of excellent quality.

Northern Rhodesia is sparsely populated. In 1931 there were 1,322,000 natives and only 14,000 Europeans. The average density is therefore 4·7 per square mile; in the Kasempa district the density is only 1·6. Barotseland, the largest district, has a population of 179,000 and a density of 5·5.

Of the total area nearly 70,000,000 acres consist of Native Reserves. Europeans occupy at present some 3,000,000 acres. The natives comprise about 60 tribes, speaking no fewer than 30 languages. They usually farm their own land, but about 30,000 leave the country annually to work in the Belgian Congo or in Southern Rhodesia. Many find employment on European farms, in the towns, and on the mines.

Barotseland is traversed by the Upper Zambezi and its tributaries. The Lealui plain, extending from Senanga northwards for a hundred miles, is scarcely higher than the river, and in the wet season is flooded to a width of thirty miles. Some of the kraals are built on low elevations which become islands during the flood season, but most of the natives retire to the hills with all their belongings. From April till June native boats are used in the flooded area; at other seasons communication is difficult owing to the sandy nature of the surface. Lealui is the headquarters of the Chief and the capital of Barotseland; the

Commissioner resides at Mongu. The natives are peaceful and ingenious and are skilled in basket-making, woodwork, ivory carving, metalwork and boat-building.

Livingstone, the largest town, has a population of 8,000, of whom 1,600 are Europeans. Its altitude is only 3,000 feet and the summer heat is oppressive. The Batoka plateau, to the north-east, carries great quantities of game, but is not suited to cattle. To the west there are forests of teak, which is carried 60 miles by light railway to the saw-mills in Livingstone.

Livingstone was the first capital, but in 1931 it was decided to move the seat of government to Lusaka. Livingstone is situated in the hot Zambezi valley, and is somewhat inaccessible from many parts of the colony, and the surrounding country is not especially productive. Lusaka, on the other hand, is healthy, and is the centre of a rich farming area. It is also nearer the mineral belt, and commands either road or railway routes to all parts of the colony.

The main line from Livingstone to the north crosses the Kafue by a fine bridge. The river is navigable for about 250 miles above the bridge, but, like the Zambezi, it overflows during the rainy season. The surrounding country is well-populated; the natives live by agriculture and fishing. Santje Hill, to the west of Lusaka, is believed to consist almost entirely of haematite.

Broken Hill was so named because geologically the district resembles Broken Hill in Australia. The principal minerals known to exist in the neighbourhood are coal, nitrates, lead, zinc and vanadium. It was here that the skull of *Homo rhodesiensis*, a very primitive human type, was discovered. Beyond Broken Hill the railway runs through one of the most highly-mineralized regions in the world.

The northern district, whose capital is Abercorn, belongs both structurally and economically to Central and East Africa, rather than to Rhodesia. The drainage is principally to Lake Bangweulu and thence to the Congo; indeed, the Chambezi is usually regarded as the headstream of that river. In the dry season Lake Bangweulu has an area of 1,600 square miles; this is more than doubled after the rains. The lake is nowhere more than fifteen feet in depth, and its shores are marshy and ill-defined. It contains many islands peopled by blacks who hunt by means of poisoned arrows. The swamps in the neighbourhood of the lake are inhabited by pygmies. To the south of the lake is Chitambo, where Livingstone died.

The Luapula, which forms part of the western boundary, connects Lake Bangweulu with Lake Mweru. The surrounding country is very beautiful, but in some areas the natives are unfriendly. Here the white man's problem is not to develop the country, but to govern and civilize the native. Fort Rosebery is the administrative centre.

The valley of the swiftly-flowing Luangwa is separated from the Bangweulu depression by the lofty Muchinga Mountains, which near Mpika rise to a height of over 6,000 feet. This valley is the most southerly extension of the East African Rift Valley. The descent from mountain-summit to river-bed is sudden, the vegetation changing rapidly from the prairie of the highland country to the dense forest and bush of the valley. The same contrast is to be observed, though to a lesser degree, on the westward slopes of these mountains. The Luangwa valley is the home of elephants, buffaloes, lions, rhinoceroses, hippopotami, leopards, zebras, warthogs and antelopes in immense numbers. Fort Jameson is the centre of a region with a small white population engaged in the cultivation of tobacco and cotton. Mails are carried along native tracks from Lusaka, 400 miles distant; there is also a mail car to Blantyre, in Nyasaland. Over large areas of the colony, the prevalence of tsetse-fly prohibits the use of transport animals.

As in the Union, railway construction in Northern Rhodesia has been due to the existence of minerals. From the Zambezi to the Congo border the length of railway, however, is only 500 miles, and further railway development is likely to be slow. The Colony possesses about 7,000 miles of roads, including some 2,000 miles of trunk roads. The Great North Road from Cape Town runs through Lusaka and Broken Hill to Abercorn and on to Nairobi. The Great East Road runs from Lusaka to Fort Jameson and thence to Blantyre. From the same nodal point there are projected roads to Barotseland, which will thus be more closely linked to the new capital than to Livingstone, which can be reached only by river. The road to the north-west will eventually join up with the Elisabethville-Lobito Bay railway.

The remoteness of Northern Rhodesia from the sea is a serious disadvantage. A remedy may be found in the proposed railway to Walvis Bay; it is also possible that the Lobito Bay line, completed in 1928, will play an important part in the development of the copper belt. But Beira, Dar-es-Salaam, and other East Coast ports are strong competitors.

The possibilities of the Zambezi as a highway of communication are greater than with other rivers in Southern Africa, for its volume is less variable, and although rapids prevent continuous navigation it is possible to 'shoot' many of the shallower rapids during the flood season. Railways are necessary, however, at the Victoria Falls, and at the Molele and Kebra Basa Rapids. Hydro-electricity is not at present derived from any of these falls.

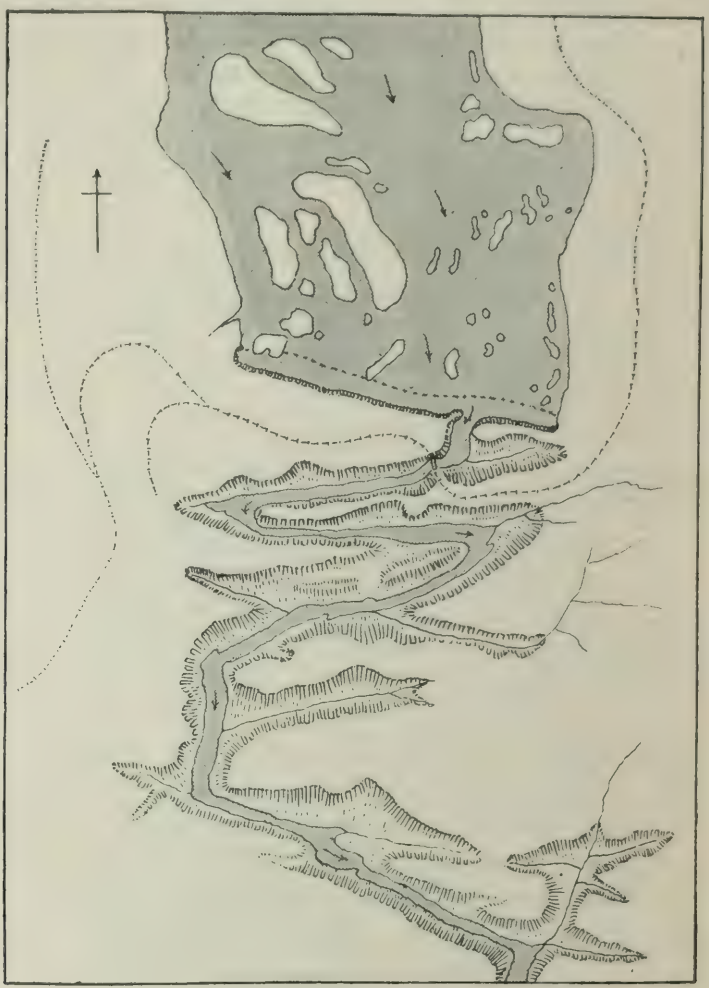
The internal trade of Northern Rhodesia is slight, and there is very little local manufacturing. Four-fifths of the exports comprise mineral products (copper, zinc, gold, vanadium, etc.). The remaining exports are tobacco, hides, maize, timber, ivory and wheat. Native labour is an 'invisible' export.

One half of the imports consists of machinery, metal goods and vehicles. Foodstuffs and tobacco, textiles and manufactured goods of every description make up the remainder.

THE VICTORIA FALLS. The discovery of these renowned falls is usually, though perhaps wrongly, attributed to Livingstone, who journeyed down the Zambezi after returning from Loanda in 1855.

Above the Falls the Zambezi is a broad and placid river, flowing serenely between the low wooded banks. Here and there are picturesque islands of varying size, covered to the water's edge with bush and trees. Looking downstream the plateau stretches to the horizon at the same general level, whilst there is no gathering swiftness of the current which is so striking a feature of the Niagara River. Suddenly, however, the great river plunges into a narrow gorge or chasm, only some three or four hundred feet in width, crossing the bed of the river at right angles. From this gorge the foaming waters find an outlet through a narrow cleft called the Whirlpool or Boiling Pot, through

which they rush with indescribable impetuosity. The river then enters a succession of steep-sided ravines having a total length, measured along their zig-zags, of over forty miles. Just below the Whirlpool, but within reach of the driving spray from the Falls, a boldly-planned bridge carries both the railway and a motor road over the Zambezi to Livingstone, six miles distant. The bridge crosses the river 350 feet above high-water level, and is one of the highest in the world.



VICTORIA FALLS AND GORGE.

The dotted line indicates the series of falls. From west to east: Devil's Cataract, Cataract Island, Main Falls, Livingstone Island, Rainbow Falls, Eastern Cataract. Railway crosses gorge just below Boiling Pot.

The Victoria Falls are not a continuous curtain of falling water; they consist, rather, of a series of falls divided by islands which overlook the brink of the chasm. The Main Falls, some 900 yards in width, are bounded by Cataract Island and Livingstone Island. Between the latter and the east bank are the Rainbow Falls and the Eastern Cataract, 600 yards across. The Fall nearer the western bank is beautifully named 'Leaping Water'; it is also called the 'Devil's Cataract.' The Falls are sometimes precipitous; elsewhere they are broken by projecting rocks, and present the appearance of a succession of cascades.

At high water it is impossible either to see the Falls or to approach them closely, owing to the vast amount of spray that springs up to meet the falling water. The atmosphere near the Falls is therefore extremely humid, and the Rain Forest, which overlooks the abyss into which the waters plunge, is kept perennially fresh and green by the drenching spray. On calm days the spray rises from the gorge in five columns, which can be seen from a

Photo.] [*S.A.R. Publicity Department.*

THE RAINBOW FALLS.

distance of 25 miles. Beautiful solar and lunar rainbows form and reform as the spray is carried hither and thither by air-currents.

The Falls have been caused not by earth-movements but by the erosive action of running water. The surface rocks consist of sheets of basalt of great thickness. These have developed a system of fissures, shrinkage cracks and faults, which have been deeply eroded by the Zambezi and its tributaries. The greatest line of weakness is that followed by the Chasm, or First Gorge ; here there was a vein of soft calcite forming a vertical break in the harder basalt. It is this softer rock which gives the Falls their precipitous character.

The Chasm is being eroded backwards by the enormous volume of falling water, but the walls of the chasm remain almost perpendicular. The Victoria Falls are quite different from those of Niagara, where the hard 'lip' of the Falls is being eroded more slowly than the lower softer rocks. Above the Falls tributaries join the main stream by wide 'estuaries,' their beds being

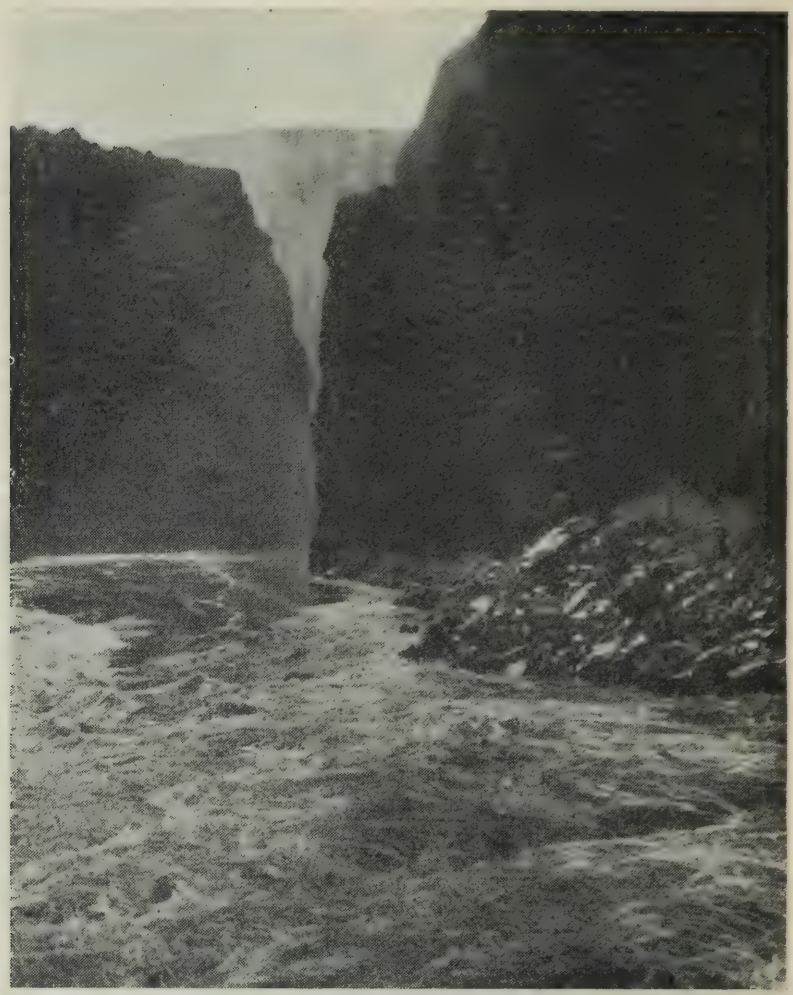


Photo.] [*S.A.R. Publicity Department.*

BOILING POT, VICTORIA FALLS.

graded to the same level as that of the main stream ; but immediately below the Falls streams fall into the Zambezi more or less precipitously. In the zigzags of the Batoka Gorge these tributaries fall by a series of waterfalls of some height and magnificence. Further downstream, however, they have cut more deeply into the plateau, so that their slope is more gradual and the fall to the river comparatively slight. Apart from the influence of tributaries, normal weathering is smoothing back the steep walls of the Batoka Gorge and the less precipitous valley slopes further east.

CHAPTER XXII.

SOUTH-WEST AFRICA.

Relief, Climate and Natural Vegetation. South-West Africa consists of a sandy coastal belt and a high interior plateau, varying in elevation from 3,000 to 6,000 feet, which falls away northwards to the Cunene and eastwards to the Kalahari. Except in the north, where the steep scarp-faces of the Kaokoveld overlook the narrow coastal plain, the western escarpment is broken and ill-defined. The plateau increases in elevation from south to north, and is highest in the Windhoek district. From the Karas Berge, near Keetmanshoop, to the Otavi Mountains in the Karst Veld, numerous highland blocks, sometimes reaching a height of 8,000 feet above the sea, rise above the general level. The highest of these is Brandberg (8,277 feet). Most of the highlands consist of granite and gneiss, with great intrusions of quartz, slate and other metamorphic rocks. The soil is composed mainly of granitic sand.

The greater part of South-West Africa lies within the Tropics, but the elevation of the plateau and the presence of the cold Benguella Current combine to modify temperature. Except along the coast, where the annual range of temperature seldom exceeds 10°, great heat is generally experienced in summer, although mean annual temperatures are not particularly high. (Swakopmund 59° ; Windhoek 66° ; Tsumeb 72°). In certain areas the winter is severe, 15° of frost having been recorded.

Since the prevailing southerly winds blow parallel to the coast, which moreover is washed by a cold current, the coast belt, except for occasional storms at intervals of a few years, is devoid of rainfall. Paradoxically, however, the region is foggy and uncomfortably damp. These conditions result from air chilled by the cold current mingling with warmer air from over the land. The joint effect of cold winds and fog is to make coast temperatures in South-West Africa the lowest in the sub-continent.

Throughout almost the entire territory the rainy season is from October to April, and in some areas only from January to March. The rainfall increases from about 4 inches in the south to over 20 inches in the north ; from Walvis it increases eastwards to 15 inches in the neighbourhood of Windhoek. (Luderitz 6″, Swakopmund 6″, Warmbad 3·5″, Aus 4·3″, Keetmanshoop 5·1″, Usakos 6·1″, Gibeon 6·1″, Omaruru 9·6″, Okahandja 14·4″,

Windhoek 14·4″, Outjo 15·1″, Rietfontein 18·8″, Grootfontein 21·7″, Tsumeb 22·1″.)

Since the rainfall is confined largely to the summer months there are no perennial rivers actually within the territory. Three streams have their source in the mountainous and fairly well-watered regions to the east and north-east of Walvis ; these are the Kuiseb, Swakop and Omaruru. In summer the waters of these rivers reach the Atlantic, but the streams flowing southwards to the Orange and eastwards to the Kalahari only carry water

Photo.] [*S.A.R. Publicity Department.*

VEGETATION NEAR SWAKOP RIVER.

for short distances after heavy rains. Usually they are mere sandy beds beneath which there may or may not be water. It was in such river beds that cultivation first began. The Cunene and Okavango, which help to mark the northern boundary, the Orange, forming the southern boundary, and the Kwando, which discharges into the Chobe Swamp, usually flow throughout the year, but they receive almost the entire volume of their waters from regions outside South-West Africa.

The territory may be divided into the following natural regions :

(1) *The Namib* comprises a coast belt of sandy desert—a waste of immense sand-dunes—together with the stony, arid country rising toward the interior plateau. The average width of the Namib is about 50 miles, although between Lüderitz and Conception Bay the desert belt is 80 miles wide. The only vegetation consists of drought-resisting plants like the cactus and the *nara* melon ; acacias grow along the river beds. Except for the coast towns, the region is practically uninhabited and uninhabitable.

(2) *Great Namaqualand* extends from the Orange to the neighbourhood of Rehoboth ; it has an area of nearly 100,000 square miles. The region is subject to prolonged droughts, whilst the rainfall averages less than 8 inches. The country is therefore barren, bearing a close resemblance to the Karroo. Enormous arid plains, sometimes supporting a vegetation of poor grass, aloes, euphorbias and mimosas, are characteristic. But the river beds are wooded, whilst the occasional rains bring to life beautiful flowers and grasses.

Photo.] [*S.A.R. Publicity Department.*

TRANSPORT IN THE NAMIB.

(3) *Damaraland* is that loftier part of the interior plateau lying to the north of Great Namaqualand. The average elevation is 5,000 feet, but the Auas, Erongo, Khomas, Waterberg, and other highlands rise imposingly two or three thousand feet above the general level. Karroo vegetation here gives place to pleasant park-like grass country abounding in game and well suited to pastoral farming. There is a good growth of timber along the river courses.

(4) *The Northern Region* consists mainly of the Karst Veld, Ovamboland, and the Kaoko Veld. The first named is a limestone region of springs and underground caverns containing water ; small lakes called sink-holes also occur. The vegetation consists of fairly dense bush with an undergrowth of grass. The rainfall is sufficient for stock-farming, and in good years agriculture can be carried on without irrigation.

Beyond the Karst Veld lies Ovamboland, a level sandy plain covered with bush and thorn-trees. Palms and baobab trees are common. Surrounding the Etosha Pan are grass flats upon which great herds of zebra and wildebeest graze. Here and there are clearings in which the various Ovambo tribes cultivate native crops.

The Etosha Pan is an ill-defined depression sometimes covered by shallow water after the summer rains. It may also receive water from the Cunene and other rivers, with which it is connected by spillways. The pan has never been crossed; estimates of its area vary from 1,300 to 3,000 square miles. Normally it is a desolate expanse of greenish clay.

The Kaoko Veld, to the west of Ovamboland, is sparsely inhabited mountainous country whose aspect becomes more and more barren as the coast is approached. The region between Ovamboland and the Okavango is tropical bush country with belts of open forest.

(5) *The Kalahari Region* occupies the extreme eastern portion of the territory. For over 300 miles northwards from the Orange the vegetation consists of grass tufts and Karroo bush, with thorn trees along the river courses. The Kaukau Veld, to the north of Gobabis, is bush country abounding in game.

Farming. The area devoted to agriculture is less than 50,000 acres. This is due to the uncertain and insufficient rainfall, and at present to the limited amount of irrigation. Maize, kafir-corn, potatoes, wheat, beans and tobacco are the chief crops; there are possibilities regarding cotton, hemp, lucerne and fruit. The most productive district is that around Grootfontein.

More important is pastoral farming, which occupies the greater part of Damaraland and Namaqualand. In the former cattle-farming predominates; the latter is better suited to sheep and other small stock. Motor transport has discouraged horse-breeding, but donkeys are still reared in great numbers.

Experts are of the opinion that the fine open ranches of South-West Africa could support enormous herds of beef-cattle. Sufficient harbours exist, whilst the distance to Europe is not great. At present there are only about 650,000 cattle, mostly of the dual-purpose type, i.e., providing both milk and beef. The number of woolled sheep is 250,000, and of other sheep nearly a million. Black Head Persian sheep, which yield good mutton, are being reared in increasing numbers. The same is true in regard to Karakuls, of which there are nearly 300,000. Nearly a million common goats are reared by the natives for milk and meat.

Live stock, beef and mutton are exported to the Union and overseas. It is estimated that four million cattle could feed on existing pastures if the veld were improved by the use of selected seed. Sheep farming could also be developed by the adoption of more scientific methods. The quantity of winter fodder that could be grown is not known, since it would depend upon the amount of water that could be raised from underground or stored in dams.

South-West Africa is fortunate in possessing an abundance of subterranean water; the supply is fairly constant and reliable even in the dry season. Extensive boring operations have accordingly been undertaken, both for watering stock and for agriculture. Where topography is favourable, reservoirs, supplied with water

from bore holes, have been constructed ; but owing to temperature and rainfall conditions there are not many reservoirs dependent upon surface drainage. Near the Auob and Nossob rivers there is much artesian water, some wells yielding a million gallons daily. In sandy river beds underground weirs are sometimes constructed ; the seepage down the moderate gradient causes large bodies of water to accumulate behind the weirs.

Mining. During the last six years the average annual value of diamonds exported has exceeded £1,500,000. They are alluvial stones, possibly brought down by the Orange River, and although of extremely small size are of very fine quality. The richest area is that between the southern boundary and latitude 26° S., beyond which point the stones diminish in size and number.

Copper is widely distributed. The principal mining districts are those of Grootfontein and Tsumeb, where copper occurs in association with lead, zinc, vanadium, silver and other metals. Exports of copper and associated ores vary, in different years, from £500,000 to £900,000. Another metal of widespread occurrence is tin. The principal mining areas are in the granite formations of the Erongo Mountains, around Okombahe, and near the Brandberg. The value of tin concentrates exported averages £30,000 annually.

Foreign Trade. Diamonds have long been the chief export, and with copper and other ores constitute more than one-half the value of the exports in normal years. Live animals, meat, dairy-produce, hides and skins and fish are increasing in importance. One-fifth of the export trade is with the Union ; most of the remainder passes through Walvis Bay. Since there is very little manufacturing, clothing, textiles, machinery, leather goods and motor vehicles, together with food stuffs, make up the principal imports. Most of the trade is with Germany.

Roads and Railways. For so vast a region, South-West Africa has a poor system of communications. The principal approaches to the Territory are from the sea, and by rail *via* Prieska and Upington. The chief towns and ports are joined by roads and by nearly 2,000 miles of railway ; this includes about 350 miles of narrow-gauge from Kranzberg (near Karibib) to Outjo, Tsumeb, and Grootfontein. The chief difficulty in railway construction lay in surmounting the western escarpment. Fortunately for the most important harbour, however, the plateau edge in the hinterland of Walvis Bay is fairly broken ; the railway from the coast follows a river valley. Owing to the absence of local coal, and since the population is so scattered, the cost of working the railways is high in proportion to returns. It has been proposed to link up the railway system of South-West Africa with that of Rhodesia in order to shorten the distance from the latter to Europe ; an extension would probably be made from Gobabis. Another much-needed line is one from Kalkfontein to Bitterfontein, for the marketing of cattle. The route to Cape Town is at present *via* De Aar.

Population. The total population in 1932 was about 270,000, and since the area of the Territory (excluding the Caprivi Strip, which on account of its situation is administered as part of the Bechuanaland Protectorate), is 311,820 square miles, the density of population is less than one person per square mile. There are about 32,000 Europeans. The German population has declined since the war; most of those that remain have accepted British nationality.

The native population (238,000) comprises many races, some of uncertain origin. Various tribes of Bushmen, speaking different languages, are scattered over the northern districts and along the Kalahari border. Most are hunters, but some seek employment as herd-boys. Namaqualand is essentially the home of the Hottentots, pastoral people who rear large-boned cattle and sheep with scraggy hair and fat tails. The Ovambo, who number about 100,000, are agriculturists and understand metal-working; they provide labour for farm, mine and railway. North of the Erongo mountains dwell the Berg Damaras, or Klip Kafirs, having the heavy frame, broad nose, and black skin of the Negro, yet speaking a Hottentot language. The Herero, called also the Damaras, most numerous in the Windhoek district, are a Negro-Hamitic people of fine physique who invaded the Territory only 250 years ago; they are pastoral nomads. (The common prefixes 'oka,' 'otji,' etc., mean 'here is,' 'here are,' in the Herero language.) The Rehoboth district is the home of a mixed people called the Bastards, who are superior in intelligence to most of the natives; cattle-rearing is their principal occupation.

The principal factor determining distribution of population is rainfall. Thus the Outjo and Grootfontein districts have each a population of over 35,000; the more central Windhoek, Gobabis, Okahandja and Rehoboth districts have each from 5,000 to 9,000, whilst the drier southern and coast districts, like those of Keetmanshoop, Lüderitz and Walvis Bay, have less than 3,000.

The towns experience difficulty and expense in procuring a sufficient water supply. Walvis Bay obtains water from Rooibank, 21 miles distant; Swakopmund is dependent upon water found under the sands of the Swakop River; Lüderitz uses condensed sea-water, as well as water brought by train from Garub, 65 miles away.

Windhoek (11,000) has a good water supply, as well as hot mineral springs, water from which is laid on to many of the houses. The town is 5,600 feet above sea-level, and is pleasantly situated amidst good pasture land and market gardens. Windhoek is the seat of Government.

Walvis (2,000) stands upon a fine bay opening to the north, and sheltered on the west by a long peninsula. A wide channel, 30 feet deep, has been dredged, giving access to a wharf, 1,500 feet in length, along which large vessels may anchor. There are three jetties for the use of smaller craft, as well as lighters, a tug, repairing slips, warehouses and cold storage sheds. Walvis is practically rainless, and is subject to fogs and sandstorms. Occasional eruptions of the sea-bed occur, when sulphurous fumes kill millions of fish. The trade of the port will be greatly increased if the proposed railway to Rhodesia is completed; it may even become a coaling station.

Swakopmund (2,000) has only an open roadstead, and its trade has been diverted to Walvis. It is to-day a summer resort rather than a port.

Lüderitz (2,000) owes its development largely to the diamond fields. The harbour is sheltered, but vessels have to discharge into lighters. The annual tonnage of vessels using the port is only about 40,000, but the passenger traffic is about equal to that of Walvis. The imports, among which timber and fish are important, are four times greater in value than the exports.

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